SCIENCE

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THE PREDICAMENT OF SCHOLARSHIP IN AMERICA AND ONE SOLUTION[1]

WHAT is scholarship? The answer is: The discovering, the organizing and the explaining of new facts. Only the uninformed and unscholarly are in the habit of designating the mere diffusion of knowledge as scholarship. The man who merely reads and speaks what he reads is no scholar, nor is the man a scholar who merely requires others to study what is already known. Any nation that believes only in the diffusion of knowledge is on the road to decay. But it is not my purpose to prove the generally accepted notion that productive scholarship is the only scholarship. We must, however, agree on the value of scholarship or the argument in this paper can have no importance. That no one may say that our subject is idle talk, I want to say, I believe for any nation that has any hope of perpetual existence that the scholars are the most essential of any class of society. And may we postulate, for the sake of the argument, that God will not provide and take care of the scholars?

And what is the predicament of scholarship in America? Simply this: That the institutions that have attempted to foster scholarship have not lived up to their opportunities. We may inquire into the reasons later. The one solution that the author proposes is to establish a new and higher institution, whose sole purpose would be to promote scholarship, and thereby furnish a new inspiration to educational, industrial and private establishments.

[1] Read before the Outlook Club of the University of Iowa at the February meeting.

I shall confine my arguments to the one field of scholarship with which I am most familiar, and trust that my readers who are most familiar with other fields will notice the close parallelism to the predicament in physics. And perhaps to those also a solution similar to the one here proposed will seem advisable.

To avoid any tone of pessimism, the views of the author will be presented in a constructive way, with the subject-matter, a plea for the physical institute in America; this institute to serve scholarship in physics much as the physical institutes of the German universities, the Royal Institution of England or the Cavendish Laboratory at Cambridge serve scholarship.

America has not led in thought since the days of Franklin. America follows thought. Consider some of the recent achievements in physical science; X-rays and their nature, Hertzian waves, liquid air, liquid helium, cathode rays, positive rays, radium and radioactive bodies, alpha rays, beta rays, the construction of matter, the photo-electrons, the theories of radiation and of fluorescence, the relations of heat conductivity to electrical conductivity. These and practically every recently proposed fundamental principle and important discovery in modern physics has have come from abroad. But it is not necessary to make any apologies in behalf of Yankee ingenuity. I am speaking only in behalf of basic knowledge.

A PLEA FOR THE PHYSICAL INSTITUTE IN AMERICA

In making a plea for the physical institute in America I am making a plea for greater efficiency in the development of pure science in this country. It is believed that the time is overripe for the segregation of a small group of the ablest scholars in experimental and theoretical physics, who shall have all the inspiration of close association with scholars in like work, all the facilities that an immensely wealthy country can provide, and who shall be free from the routine work of clerical management or the routine of teaching of disinterested or incapable students. The argument is simple and it is believed irrefutable, and is presented without in the least minimizing the value of a scattered scholarship for the general inspiration of a student body and the general public.

The time is believed to be overripe because we are spending more money on higher education per capita than any country of the globe, and at the same time it would be bold to claim a second-rate place for ourselves in the development of pure physical science. The situation generally in our universities is such as to discourage the development of capable and promising young men by management that encourages faithfulness to second-rate ideals. We are already on the verge of an over-production of zealous and promising scholars, who can see no future other than that of servitude in the small college or with detail or clerical work in a laboratory swarming with students. Admit if you will that it is all good work and also that the soul must do penance, nevertheless the bright and capable young man, even if he has a vision, insists on looking ahead to a life of respectability and achievement with an ultimate freedom from the worries of the things of life.

Our commercial enterprises are just discovering that much of this ability can be easily and most profitably adapted to the advancement of applied science. And it must be said to their credit that they already bid fair to surpass most of our universities in pure science, even though their ideal is admittedly to make scholarship pay in the near immediate future. The

wonderful success of some of our commercial research laboratories should furnish a genuine stimulus to those of us who believe in greater opportunities for pure science. Of course if we should not believe in a scholarship in science which is not hampered by questions of immediate rewards, then there is no occasion for the plea in this paper. A discussion of the organization and the scope of a working institute can best be given after we have first analyzed somewhat in detail the existing conditions which are manifestly not as efficient as they should be. And lastly, we should be in a position to outline a tentative plan for the development of the organization.

THE SITUATION IN OUR UNIVERSITIES

The idea of the physical institute is to supplement the work of our universities by founding a higher standard and furnishing a new source of inspiration. True enough, our universities have sufficient resources to properly foster the work of a physical institute, and there is an abundant supply of men forthcoming. Moreover, they believe in general that productive scholarship is the most important function of a university and it is agreed that genuine scholars are of the most rare and difficult type to develop. But the difficulty with our universities is one that arises from mixed ideals, particularly in our state universities. The ideal of competition perhaps takes precedence of all other ideals in practise, and along with this is associated the ideal of efficiency in detail management of students. Surely a university wants scholars, but it wants a large number of students first. It wants more students in order to convince the people of its greatness, so that it may get more money so that it may establish more departments, and so get more students, and so on. It must do extension work so that the work of scholars may reach every citizen of the land within a few days after it has been accomplished. Energy and resources that might be directed toward scholarship are scattered in every direction that human imagination can conceive of. The ideal in practise is not how great scholarship, but how thin can it be spread. In other words, there is in our scholarship a strong tendency toward democracy gone mad. Now if only one side of the situation in our universities is emphasized, may it be remembered that the author wishes to make clear a difficulty which can be side-stepped in one particular by the organization of the physical institute. Of course the administrative authorities of most universities would remind us that they are building for the future. Their ideal is service in a broad sense. Scholarship first in so far as it is first in service to the immediate mass of humanity. Scholarship for the sake of scholarship—never! But if we will admit the result of the recent investigations of Professor Cattell, which is that our administrative officers generally can have no vision of the value of scholarship to the future of society, we can proceed with our argument. The argument of the administration against scholarship is much like that of one farmer toward the education of his son. No, no, my son, you must stay out of school a few years and safeguard the future. We will raise more corn and feed more hogs, so that we can buy more land, and raise more corn, etc., and by and by you can go entirely through the university and take your brothers and sisters along if you yet have the desire.

The predicament of the state universities is well stated by Professor Geo. J. Peirce:

> The masses of a democracy recognize present wants more surely than they anticipate future

needs. They require an immediate supply to meet an existing demand. They consider a state university to be well fulfilling its function if it furnishes such a supply. . . . But the wholesale business of the state university limits if it does not prohibit that attention to the exceptional student which may result in training a leader of his generation, a seer who, divining the future needs of the state, may begin to prepare to meet them, a man who, profiting by the recorded experience of the past, may mold as well as meet conditions.

And what has been the result of the material growth of our universities on the development of physical science in this country? We have laboratories of marble and cases filled with apparatus, and hordes of students, and a wonderful machine-like system to care for these students. But the efforts and resources adapted to scholarly purposes are not at all in proportion to merit. Even now we are confronted with a difficulty which shows us the need and opportunity of concentrating our efforts toward scholarship. Every year we have young men of good promise who either can not find positions at all in our universities, or who are compelled to take positions with such requirements and surroundings that the development of the individual is practically impossible, and at the same time every year the universities can not find enough mediocre men at salaries ranging from $600 to $1,000. The demand is for men who will take care of these hordes of students, men who will lead these students by the hand and feed them with a spoon, men who will set up elementary experiments, grade notebooks and daily examination papers, and correct English, and who thereby make parents and patrons believe that everything is moving along smoothly and efficiently. For if the students do not appear to be busy the institution will get a bad name and the number of students will not increase. And what can be worse than an idle student body or a lack of increase of students. It is no doubt true that in some instances scholarship is not developed in physics because the members of the department staff are beyond hope of becoming scholars and they either have no knowledge of what tends to develop scholarship or are afraid that some individual might develop who would be a greater man than those on the ground floor. But this latter is pure hypothesis.

What is needed is a higher light on American soil. Too many professors are satisfied to spend their time making out and mimeographing notes and examinations, and even making apparatus, or in conferences with the laggard students, or perhaps with unimportant committees. Sometimes they do not realize how poorly they invest their time when they are merely reading and becoming informed, as it were. Frequently professors keep themselves so busy with labors like the above and even such cheap labor as dusting apparatus that they do not have time and energy left for the merest semblance of thought. Productive scholarship is the flower of our educational work and that individual who shows tendencies to bloom should be allowed the every ounce of his energy to apply in this direction.

I believe it is not fair to blame the ruling bodies of our institutions too much, for they are merely the creations of a complex set of circumstances in our overemphasized democracy. Men with ideals when in power find themselves faced by situations which seem to require a single line of procedure in order to preserve any semblance of power. The reader will please not understand that our universities are devoid of good administrators, or that scholars are unknown. Moreover, there are evidences of forces at work for the improvement of our administrative methods in the universities, and there are urgent appeals for the improvement of scholarship. But I be-

lieve that the progress can be made more rapid, and that scholarship in theoretical and experimental physics can be more quickly put where it should be by the development of a new and higher institution, which shall be largely unhampered by the accustomed administration and students of our universities.

And I can not proceed further without saying a familiar word about our students. The students in our universities may be divided into three classes, as follows: those who early in their university career think they know how they wish to function in society and who remain in the university primarily as an aid to carrying out serious purposes—those who attend the university for a pleasant life and ultimate social standing primarily, who, like Micawber, trust that something will turn up—and those with a serious desire to specialize in some line of human activity after they have obtained some notion of the relative merits of the various classes of activities and their own fitness and interest.

Those of the first class constitute a large portion of the students of our professional colleges. The average brightness and capability of this class is very good. Perhaps this is because of the definiteness of procedure, and the assurance of a life of comfort and respectability. Perhaps some are afraid of being classed with the non-serious, purposeless ones and again some do not trust themselves to a broad career with its many chances and pitfalls.

The second class are the most numerous generally. They sometimes study elementary physics, and they usually get some good as a result of their sojourn in the university. No doubt the average of society is raised. Some who come to scoff remain to pray. The only objection to this class of students is that they are not worth their cost. Of course they can not be eliminated because of the difficulty of discerning who belongs to this class and because of the political dangers. The students of the third class are all too few in number, and of this class the contamination by the other classes is so great that the net weight is frequently vanishingly small. From this third class we should draw our scholars in all fields of pure science and the humanities, our artists, our administrators in many fields, including senators, representatives, college presidents and leaders, wherever there is a fight between the old and the new, because forsooth these men should view human activities in the broad sense, and therefore should recognize what efforts conform to the development of society and the universe.

Now the great criticism that a physicist in particular may bring against our universities is that the cream of the time and energy of the university professor is taken in contact with students of classes one and two.

THE SITUATION IN OUR INDUSTRIES

And what is the situation in our industries that we should declare that it is impossible for industrial research laboratories to properly develop science, no matter how much wealth and energy they may expend for investigation. In order to answer this question we may inquire into their ideals and methods, their resources and their achievements.

The ideal in our industries is admittedly investigation that pays, *i. e.*, investigation for a useful purpose. Now, as Dr. Whitney points out, the pay comes in two directions—one in returning more dollars and cents than is invested in the research laboratory, and, secondly, in maintaining the practise of the manufacturing concern by being ready to cope intelligently with any other concern that may attempt supremacy as a result of new discoveries. It may be unfair to pronounce upon the question as to whether there is a soul in a commercial enterprise that leads it to desire to achieve

for no other reason than to keep its name and its work preeminently on the map throughout the ages. Perhaps this latter phase of the ideal may exist even though its workers may be largely unaware of it. At any rate, I believe it is generally admitted that it is desired that material rewards shall be forthcoming in the near future. If it could be that wise leaders in industrial research could recognize the value of pure science to the industries centuries hence, then there would be not so urgent a plea for the physical institute. But these concerns are of human hands and in a democratic country, and the resources generally come from individuals who expect dividends at least in due time to be incorporated in the death wills of the stockholders. I believe that as a corporation grows large it tends toward the recognition of values other than immediate money values. If so this is cause for larger faith in humanity. In fairness we must also recognize the struggle for corporate existence the same as we recognize the struggle of the individual. It is, for example, perhaps difficult to know to whom should be given credit for the establishment of such able and broad-minded leadership as prevails at the General Electric Company's laboratories.

The pure scientist believes that it is most difficult to obtain willing and capable men who will devote all their energies to the search for new knowledge by the free and methodical movement of the human mind, without regard to practical applications and money rewards. He believes further that this is the only royal road to intellectual achievement, and yet he is not unmindful that some time or other much of the knowledge will be absolutely necessary to the existence of the human race. He believes that the man who investigates with a commercial purpose in view has a handicap load that must limit him in his arduous search to the extent that such an investigator can only be half a scientist.

The attitude of the commercial scientist may be gathered from the words in part of Dr. Arthur D. Little in his recent presidential address before the American Chemical Society:

> Most of us believe that the doctrine science for science's sake is as meaningless and mischievous as that of art for art's sake or literature for literature's sake. These things were made for man, not for themselves, nor was man made for them.

The pure scientist is perfectly aware of the immediate value to humanity of this attitude, but at the same time he insists that there should also exist a body of most capable thinkers who shall not be limited by placing dollar signs ahead to mark out the paths. Even from the standpoint of service the dollar mark often leads away from the best route or the safe route. For what man of Faraday's time could have predicted that within a century the electrical industries of one country would be facing a capital requirement of $8,000,000 a week.

That research pays our industries acknowledge fully. They are aware that in farming alone investigation has resulted in the saving of about $1,000,000 in the labor cost of a single crop and a very much larger saving as a result of increased yield, as compared with fifty years ago, or that in electric lighting alone fully the same sum has been saved annually as a result of the progress in the last ten years. And I doubt if it could be estimated the returns that have come to the steel industry or the telephone industry as a result of their years of special researches. According to Dr. Little there are several industrial firms that are now spending $300,000 annually on their research laboratories, and many more, $100,000 a year. These figures should certainly make those interested in the promotion of pure science take notice. It is perfectly obvious that it is a concentration of effort and resources of our much-talked-of trusts that has made possible these wonderful expendi-

tures and the advances which have followed. As a result of cooperation of several firms we have the National Electric Lamp Association Physical Laboratory at Cleveland, which perhaps approaches more nearly to a pure-science laboratory than any that are fostered by the industries. But this laboratory can not divorce itself from the interests that nourish it. Its investigators will naturally have regard for problems which seem to bear on the industry.

Also there is the Bureau of Standards, whose good work is so well known. This bureau spends annually about $700,000. But the spirit of this institution is toward the refinement and the standardization of the best that has been or about to be accepted in the scientific world. The scientists of this bureau are in a sense the conservers of scholarship. It is only occasionally that they expend energy toward the development of pure physics. They find plenty to do in the field they have chosen. It is very doubtful if this organization with its congressional control and red tape would be conducive to the free and easy movement of the human mind in scholarly productions.

In this connection the opinion of General A. W. Greely is worthy of note, which is:

> The failure of our government to properly recognize scientific work appears to be due to an antiquated and inherited policy, which must be to the ultimate detriment of the common weal. This year the attention of the government has been urgently called to the untoward conditions, arising from illiberal treatment of expert officials. Distinguished chiefs of several important national bureaus officially report increasing difficulty in maintaining an efficient scientific staff. Unusual and steadily increasing numbers of scientists and experts are accepting commercial positions in order to meet the enhanced cost of living.

THE ORGANIZATION OF THE PHYSICAL INSTITUTE

The organization of the physical institute should be such that a few of the greatest world physicists could be induced to join it and remain with it. The things that such a man needs are freedom from cares concerning food and shelter, livable surroundings, human associates who are interested in like work, and freedom from petty administrations, and perhaps the last two would be most effective in retaining men and keeping them effectively at work. Our universities and government bureaus frequently furnish the first two requisites, but seldom the last two. If any furnish all four, I shall let those who know say it.

The first condition would perhaps be filled satisfactorily if the physicists could have a salary of $10,000 each. The surroundings should be a laboratory fully equipped, situated preferably in some quiet spot and beautiful and within easy reach of some metropolis. Nearness to some large university would also be helpful.

The associations would be partly supplied by the other men of precisely equal standing at the laboratory, but this would not suffice for the men or the cause. There should be a number of fellows of standing about equal to that of our best new doctors of philosophy. They should obtain stipends of about $1,500, and should be allowed to keep these appointments for as many years as they see fit, of course devoting their time to research, with all the aid that they can obtain from the honored physicists, or honored professors, if you prefer. Also there should be as many students in theoretical and experimental work as the honored professors might wish to accept.

The administration should be entirely in the hands of these professors, who may elect a qualified secretary to take care of the routine business management. Any new appointments to the professorships or fellowships should be made only in case of

deaths or voluntary removals. No alteration should be made in the salaries or the essentials of the organization except by unanimous vote of the administration. The institution should be conservative, so that there might be no occasion for troubles and so that there might be ample time to test the ideal of the laboratory.

The institution should have the power to confer a special honorary degree on any man of the institute or elsewhere for preeminently noteworthy work in physics. This degree should bear no relation to the period of service of the candidate. This would aid in giving the institute a rightful leadership in scholarship.

An American institute for physics with the ideal for scholarship alone, should be fostered by private endowment, by a governmental bureau or by a national university, but hardly by any university such as exists already. A private endowment would be preferable from all points of view save perhaps one, providing of course that no strings were tied to the endowment inconsistent with the ideals of the institution. A privately endowed institution might not tie itself up with our nation and our existing educational institutions as fast as if it were otherwise fostered. And yet the success of the Rockefeller Institute for Medical Research would tend to dispel this notion. The capitalization need not be beyond a private endowment, for the income could be less than that spent by many industrial concerns on research, but of course more than spent by most universities for research.

A governmental bureau might foster such a project if it could only have a charter that would insure it a semi-permanent freedom from disturbances arising from the petty rules prevailing generally in our governmental bureaus. Such an action by our government would create a tremendous sentiment in favor of scholarship throughout our democracy. It is not unreasonable to expect that national support of scholarship would create a national spirit somewhat like that in Germany, for it is well known that the government there has long fostered scholarship and that German industrial supremacy has come as a result of supremacy in productive scholarship. According to Professor Mann, Germany has established a separate lot of schools to take care of the technical education which our state universities feel called upon to provide for.

The government might cooperate in a physical institute somewhat on the basis of the work done by the Carnegie Institution. Already this institution serves purposes closely akin to those of the proposed physical institute, particularly in geo-physics and in terrestrial magnetism, and yet there are obvious distinctions.

A national university might foster a physical institute properly, but there are grave doubts. It is not clear how such a university could be founded on federal support without the injurious meddling of the demagogue, who can not recognize any good to society that is not certain to extend to the masses in the present or near future generations. The attitude of Willet M. Hays, for example, who holds that a national university should reach ninety per cent. of the people in the present generation, may be all right for a technical school or high school, but this attitude should be regarded as positively vicious when applied to a national university. As the Assistant Secretary of Agriculture points out, already applied science is developing much faster than pure science. My opinion is that this only emphasizes our great need for institutions that shall develop leaders and prophets. Such an institution could, if properly chartered, in-

corporate a worthy physical institute. And this institute could pilot the way in those things that pertain to the development of physical science. A reasonable number of promising sudents would furnish working material for the honored professors, and later they would spread the gospel.

The publication of the work of such an institute would be a matter of detail and one that would take care of itself. I believe that a suddenly created national university with the proper ideals is an almost Herculean task. However, if several institutes of the character of the proposed physical institute could be founded one by one, these could later form a loose union for cooperation without waste of energy or loss of spirit.

If my readers are inclined to admit the strength of the argument in this paper when it is considered in connection with the efforts of our state universities, but not when considered in connection with our endowed universities, they should be reminded that the latter type of institution has not succeeded in retaining such physicists as Rutherford, Jeans, Richardson and Maclaurin. Other foreign physicists have even declined to try our atmosphere. Our self-respect demands that we attempt to create one center of physical research to which eminent world physicists would be willing and happy to come. I believe that with the establishment of the physical institute we should soon have the spirit, intelligence, work and courage of the American university professor in physics raised to such an extent that men would be honored with salaries as well as with ranking titles, such that the fellowship of students would mean inspiration rather than a deadly burden, such that irregular administrative management would not be tolerated, and such that a correct public sense of values would be established.

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THE NEW MECHANICS

In the past decade, rumors have become current that physicists were attacking critically the ideas which have been accepted in mechanics since the time of Newton. Articles have appeared which assert that there are two mechanics, the Newtonian or classical, and the non-Newtonian or modern. And it must occur to many to ask whether this is to be a war of words, as has so often resulted from looking at the same thing from opposite sides, or whether we are living in a world perplexed by two rulers, for we have pretty generally submitted to the doctrine that we and the rest of the universe are parts of a mechanical machine. And it would be an additional perturbation, in these already troublous times, to have to decide which governor to live under. While the laws of mechanics will probably be modified, still we are now certain that the changes will not affect problems involving matter in any of its ordinary aspects. The human race, in its present state of existence, will thus continue to conform to the laws of Newtonian mechanics; but we must be prepared for an early proclamation from Sir Oliver Lodge, the apostle of the science of spiritual mechanics, that death is merely the transfer of those complexes of the ether, called man, to a massive empty space governed by the laws of non-Newtonian mechanics—where our spirits move hither and thither with the velocity of light, and think with an energy comparable to the explosion of an atom.

The real issues of this very important discussion of the laws of mechanics are now fairly determined, and when the Société Française de Physique made them the subject of a conference, no one could have been found better fitted to state the case than M. Paul Langevin, of the Collège de France. Now that his opinions have been published, it is comparatively easy to present the ideas

underlying the new mechanics as a survey of his article.[1]

M. Langevin begins his discussion with the statement that the idea of mass has been the fundamental concept of mechanics since the time of Newton, and that it may be introduced in three different ways which correspond to three aspects of inertia. We may define mass as the coefficient of proportionality of force to change of velocity as derived from the formula, force equals mass times acceleration ($F = ma$); as capacity for impulse or quantity of motion, from the formula, momentum equals mass times velocity ($G = mv$); as capacity for kinetic energy, from the formula, kinetic energy equals one half mass times velocity squared ($w = \frac{1}{2}mv^2$).

Rational mechanics, to be consistent, requires that there must be perfect equality among these three definitions of mass, and that the mass of any portion of matter must remain absolutely invariable for all velocities and for all changes of the body, whether due to physical, chemical or mechanical agents.

By inertia we ordinarily mean the property which matter possesses of tending to preserve its state of rest or of uniform motion in a straight line; that is, matter resists any change of motion in such a way that an external action or force is necessary to change the quantity or the direction of a motion. Newton based mechanics on this constant proportion between force and change of motion, or acceleration; and he defined mass to be the constant of this proportion. He thus assumes that mass, determined in any other manner, will give a consistent result with his definition.

And since the time of Newton, every treatise on physics has begun with this assumption, that inertia is the fundamental property of matter, in the sense that it can not be expressed in simpler terms. Indeed, for more than two centuries, it has been held to be the essential doctrine of mechanics, that a physical phenomenon was satisfactorily explained only when it was reduced to a type of motion governed by the laws of this rational mechanics, and particularly by the law of inertia.

But now, after a searching criticism of the postulates of mechanics, many physicists have come to the conclusion that inertia is not a fundamental property of substance, and they claim to have proved that it can be reduced to simpler terms by the laws of electromagnetism, which show evidence of being simpler and more fundamental than the laws of dynamics.

First, because it can be proved that inertia is not invariable, since the quantity of mass, as measured by the three definitions given above, ceases to be the same when the velocity of matter is not small compared to the velocity of light.

Furthermore, although for small velocities the three definitions of mass agree and assign to a given portion of matter a definite initial or "stationary" mass, m_0, yet even this initial mass depends on the physical and chemical state of the system and also varies for each change of state which is accompanied by an interchange of energy with an outside body.

This evidently means that, if a body radiates heat, light or electro-magnetic waves to other bodies, or if a body unites with another to form a new chemical compound, then the mass of the body in each case changes. The relation between this change of mass and the change of energy is found to be a very simple one, as the change of mass equals the change of energy divided by the velocity of light squared, or

$$m - m' = \frac{V^2}{w - w'}.$$

It follows because of the law of the conservation of energy that in a system of bodies whose separate parts mutually exchange energy, the masses of the separate parts vary, but the total mass of all the parts added together remains constant, if the system as a whole does not change its total quantity of energy. Thus the law of conservation of mass is merged into the more fundamental law of conservation of energy.

The inadequacy of mechanics became apparent when physicists attempted, without success, to explain electro-magnetic and optical phenomena from the accepted mechanical laws. We now see, as Professor Einstein has shown

[1] P. Langevin, "L'inertie de l'énergie et ses consequences," *Le Journal de Physique*, July, 1913.

by the principle of relativity, that an essential error was introduced when the formulæ of dynamics and those of electromagnetism were assumed to lead to the same conceptions of space and time. According to the new mechanics, our ideas of time and space, obtained from mechanical notions, are only approximately true, while those derived from the laws of electromagnetism are correct. The result is many physicists of the new school are now seeking for an interpretation of inertia from the laws of electromagnetism rather than to continue to explain the laws of electromagnetism by mechanics. These laws of electromagnetism have the advantage of great simplicity of form which may qualify them to serve as the fundamental principle of all physical laws.

The germ of these new views of electromagnetism is to be found in the work of Faraday and Maxwell. Their true experimental foundation is Rowland's experiment, performed in 1878, when he found that an electric charge, if it be carried through space with a high velocity, acts like an electric current in that it creates about itself a magnetic field. Three years later, J. J. Thomson showed that, if an electrified body moves through space, it not only creates a magnetic field in the surrounding space, but also that this magnetic field is a form of mechanical energy; from the law of the conservation of energy, this energy must be acquired at the expense of an equal amount of energy localized in the free space about the body. Now it can be shown rigorously that this "magnetic" energy has all the characteristics of a kinetic energy, since it is proportional to the square of a velocity and contains a factor which corresponds with the mass as given in the third of our former definitions. This supplementary inertia of electromagnetic origin results solely from the fact that the body is electrified, and it is an addition to the stationary or initial mass which was denoted by m_0.

The result is the same if we consider the second definition of mass, as a capacity for impulse or momentum. So soon as a body is electrified and moves, it develops a supplementary capacity for momentum which agrees with the supplementary capacity for energy which has just been described. Poincaré, in order to preserve the fundamental law of the conservation of momentum, has shown that it is necessary to localize a quantity of momentum in space just as we were forced to localize a quantity of energy in space. Thus the fundamental consequence of rational mechanics, requiring the three definitions of mass to agree, is not satisfied for all cases of motion.

These ideas have affected our notions of space. Maxwell deduced as a consequence of theory that rapid and periodic variations in the electrical charge of a body should be propagated through space with the velocity of light. The existence of these electromagnetic radiations was verified experimentally by Hertz, and in the hands of his successors this new form of radiation has attained great importance under the name of wireless telegraphy. A theoretical consequence of this radiation is the now generally accepted belief that light is merely a type of electromagnetic radiation of excessively rapid vibration. To transfer the phenomena of light from a mechanical to an electromagnetic manifestation of energy was to shake profoundly the belief in the fundamental and universal nature of mechanical energy.

Another very important principle of rational mechanics was embodied in Newton's third law of motion, that to every action there is an equal and oppositely directed reaction. But we have not been able to make the forces created by an electrified body in motion conform to this law. This is especially evident when radiation also occurs. Let us suppose that an incandescent body is giving off light (*i. e.*, electromagnetic radiation) uniformly in all directions. By reason of symmetry this radiation exerts no resultant force on the source. But if the perturbation, in the form of a wave, encounters an obstacle at a distance, then we know, both from theory and from experiment, that the obstacle will be subjected to a force due to its absorbing a part of the radiant energy. This pressure of light pushes the obstacle in the direction of the propagation of the light, and the action thus exerted on the

distant body is not compensated by a reaction appearing at the source or on any other portion of matter. We thus have cases of actions without reactions, if matter alone is considered.

It must be clearly understood that the discrepancies involved in the results of the rational mechanics, which have been cited, do not become appreciable except under unusual conditions. We can still consider mass as an absolute constant and the equations of dynamics as exact, unless matter has a velocity exceeding 18,000 miles a second, or for changes of state which involve enormous quantities of energy, such as those associated with radio-active bodies or those which accompany the formation of the chemical atom. At the present day we have made no progress in attaining any of these conditions, for even in the case of radio-active bodies we should need to find a method of liberating their energy in hours rather than in hundreds of years. Thus the problem would have remained academic, if theorists had not advanced the hypothesis that electricity is atomic in nature and that the electron, as the least portion of electricity is called, ordinarily attains a velocity which does exceed a velocity of 18,000 miles a second; that radiation must be explained as a transfer of an entity, energy, through space; and that the chemical atom of the radio-active elements decomposes spontaneously and of all other elements is theoretically decomposable with the evolution of an enormous amount of energy. All of these theoretical cases would make the discrepancies between the laws of mechanics significant.

It would exceed the limits and the purpose of this article to attempt to follow M. Langevin in his exposition of the properties of electricity and of matter, of inertia, of radiant energy, and of the principle of relativity. After all, these abstruse questions are proper for the discussions of specialists as they deal with the nature of matter in a state quite outside the limits of observation. But however the hypotheses of electrons and the ether may impress the world as being matter of definition and words rather than of substance, yet from them follow conclusions which can be tested experimentally. And the conclusions to be drawn from the new mechanics are interesting.

For example, from the assumption that the mass of a body varies when it gives out heat or light, we must conclude that if a pound of water at 32° Fahrenheit were heated to 212°, its inertia or mass would be greater. Unfortunately, when we calculate the increase of the mass for this or for any practicable heating of a body, we find that it is entirely too small to measure.

Again, let us put a known mass of hydrogen and oxygen in a closed vessel and cause them to unite to form water. Since the union of these gases liberates an immense amount of energy in the form of heat which will be radiated from the walls of the vessel, the mass of the water must be less than the combined masses of the two gases. But unfortunately again, the calculated decrease in mass is only a five-billionth part and thus entirely too small to measure.

Lastly, the radio-active bodies give off an amount of energy much greater in proportion to the mass acting than can be obtained by any chemical or other process. We might hope to measure the decrease of mass in these cases, but we can not, because these bodies give off their energy far too slowly.

Such, in the main, is M. Langevin's exposition of the new ideas in mechanics. There is not the least doubt that this rigorous searching of the classical mechanics has been a most important advance in science, and we are certain to find its laws must be revised in order to make them conform to the more rigorous exactness which is now required of mathematicians. But it is equally certain the laws of mechanics have withstood this criticism extraordinarily well, in so far as they have been unshaken when we are dealing with motions which can be attained by bodies of sensible mass.[2]

[2] That is, Newton's laws of dynamics are rigorous when bodies of tangible size, acting in measurable spaces and times, are investigated. They are approximations for exceptional cases; in much

The divergence of the new and the old mechanics occurs only for actions of separate electrons, of unattainable velocities, of energy existing in the chemical atom, and of radiant energy in empty space unassociated with matter. Now there are many men of science who think these problems are metaphysical, in that they do not deal with measurable bodies or with phenomena capable of experimental verification. And there is a great likelihood that problems of such a nature are incapable of scientific solution and are apt to drift into a discussion more of definitions and of words than of objective facts.

The warning which was given by Poincaré, shortly before he died, is one to be heeded by the over-zealous.

> If, however, in some years, its rival (the new mechanics) triumphs, I shall venture to point out a pedagogic error that a number of teachers, in France at least, will not escape. These teachers will find nothing more important, in teaching elementary mechanics to their scholars, than to inform them that this mechanics has had its day, that a new mechanics where the notions of mass and of time have a wholly different value replaces it; they will look down upon this lapsed mechanics that the programs force them to teach and will make their scholars feel the contempt they have for it. Yet I believe that this disdained classic mechanics will be as necessary as now, and that whoever does not know it thoroughly can not understand the new mechanics.

LOUIS T. MORE

UNIVERSITY OF CINCINNATI,
December 3, 1913

GEORGE WESTINGHOUSE

MY acquaintance with Mr. Westinghouse commenced in the spring of 1867 in Pittsburgh. He was at that time introducing to the railroads a patent car replacer and a double-headed railroad frog, both of his invention. These were being manufactured by Messrs. Anderson, Cook & Company, crucible steel manufacturers, I being employed by the same company. He was doing the selling—at the same time making his first acquaintance with railroad men, so valuable to him in later years. We lived at the same hotel and later on, after we were both married for about a year, we lived in the same house on Penn Avenue, next door to where the great Westinghouse Building now stands, and, being of congenial tastes, our acquaintance ripened into a warm friendship which continued up to the time of his death.

the same way as his more universal law of gravitation is accurate for ponderable bodies but fails for intangible molecular bodies.

During this time he often talked of the idea of operating the brakes of a railroad train by compressed air, one of the greatest advantages of which he thought would be the putting of the full control of all movements of the train into the hands of the engineer. He had witnessed a collision between two trains and saw the necessity of some better apparatus for controlling their speed than what was then in use. Not having the money to pay the expense of the first equipment, which only amounted to $750, he gave a very substantial interest in the patent to one of the men who was afterward associated with him, in return for the necessary capital. This gentleman made over $2,000,000 out of this interest in the Brake Company within the next twenty-five years.

He soon had all the details of the new invention worked out and the first train equipped. It was first tried on an accommodation train on the P. C. & St. L. Railroad, running west from Pittsburgh. It was a success from the very first, preventing a bad wreck and probably saving several lives within a week after its installation.

A company was soon formed and the manufacture of the brakes was commenced within a few months. He added from time to time improvement after improvement until in 1886 he brought out the automatic quick-action brake. The greatest rival of the air brake at that time was an electric brake. After studying this problem for some time, Mr. Westinghouse announced to his associates that he had conceived the idea of an improvement in the air brake that would make its operation quicker than the electric. No one could understand how this could be true, but when the brake was constructed and put in operation they found it was a fact.

The results of the working of this improvement proved that it was very much superior to the older form and that his claims were correct. The company then equipped a 50-car train with the improved apparatus. This was taken all over the continent from Boston to San Francisco, giving exhibitions at different points.

This settled the question beyond any doubt as to which was the best brake, and nothing more was heard of the electric brake, until the latest invention by Mr. Westinghouse within the last few months of the electric pneumatic, which is, as its name implies, a combination of the use of electricity and air pressure.

He early turned his attention to railroad signaling and was the father of the modern automatic signal, first using compressed air and later electricity and a combination of both.

The inventions of Mr. Westinghouse have done more for the safety of the railroad traveling public than those of all other inventors that have ever lived. People who travel will never know how much of a debt they owe for their safety to him. The fact is that to-day the safest place for a man to be is on a railroad train. This is proved conclusively by the fact that accident insurance companies pay double the face value of their policies if the death of the insured occurs on a public conveyance.

I think that the invention and development of the air brake was Mr. Westinghouse's greatest work. It certainly has done more in saving lives and making travel safe than all other inventions put together. The present generation can never know how much it means to them, but they will remember the name of Westinghouse more in connection with the air brake than anything else.

Mr. Westinghouse was quick to grasp the possibilities of any great invention or enterprise. This was shown in his development of the use of natural gas in Pittsburgh. The iron manufacturers of Allegheny County had been watching the use of this wonderful fuel by one mill for 15 years, all of them saying that it could be only temporary and would soon give out. After Mr. Westinghouse's attention was called to it and he began studying the subject, he made up his mind that the supply of natural gas was immense and would last long enough to warrant the organization of a large company for its development and distribution. He, therefore, organized the Philadelphia company and in a few months had Allegheny County literally ablaze with the gas from many wells and was supplying the mills and private residences with the new fuel at a price which saved them millions of money besides paying handsome dividends to his stockholders.

To him more than any one else in this country is due the development and introduction of the alternating electric current. The story of its introduction in this country is well known, having been told by better pens than mine. The extent and magnitude of his electric and machine works far surpass any of his other enterprises. At the time it was built the floor space covered by the British Westinghouse Works at Manchester in England was as much as the combined Westinghouse electric works and the Westinghouse machine works in East Pittsburgh.

George Westinghouse had unlimited faith in himself and he had the courage of his convictions. He never asked his associates or the public to invest in anything in which he would not risk his own money. All of his stockholders could be dead sure of always having a square deal from him.

A frenzied financier once made a proposal to him which involved the sale of a company whose stock he controlled. The scheme as proposed by this man was that the stockholders were to get one price for their holdings while Mr. Westinghouse was to receive a much larger price for his. His reply was one of the most indignant, scathing and cutting letters that I have ever read and must have been anything but pleasant reading to the receiver.

It is given to very few men to be responsible for the creation of such great enterprises as those which were founded by Mr. Westinghouse, and he was justly very proud of them and of what they had done—but more than all else

for what they had done for humanity, especially in the introduction of the air brake.

We who knew him best were very proud of him and could not but love him, and for that reason we could have wished that he had devoted less of his time and energy to his enterprises in Europe and more to those on this side of the Atlantic. He would have had very much less worry and more peace of mind and comfort during the last few years.

He had a dream of seeing all of Great Britain's system of railways electrified. He thought the time had arrived when it could be done. This was his reason for the erection of the great works at Manchester, but he was a little ahead of the times. England is an ideal country for such a possibility, a network of railways, an immense number of short light trains, and coal mines so near that it would be quite within the range of developed possibilities of to-day to have the electric current generated by gas engines at the mines and distributed all over Great Britain by the high-tension electric system. None of the lines would have to be more than 200 miles long, most of them much less.

There are several schemes to erect monuments to the memory of Mr. Westinghouse. There can not be too many, or too costly; but after all the greatest and grandest monuments are the ones he built himself—the great works all over the world employing some sixty thousand workmen and two hundred million dollars capital.

Mr. Westinghouse was in every sense a thoroughly practical man. He knew how to manage men and how to handle tools with his own hands. In going through his great shops with him I have many times seen him stop and show the workmen that what they were doing was wrong, and then he would take hold and show them the right way. Workmen always respect such an employer.

He cared little for music, art or amusements. His favorite recreation was the working out of some new mechanical problem. Many a night after spending the evening with his guests I have known him to work until the small hours of the morning with pencil and paper over some new idea that had come to him.

He was given many honors both at home and abroad—among the principal ones are the Legion of Honor of France, The Royal Crown of Italy and the Leopold of Belgium. He has been awarded the John Fritz medal and the Edison medal, and just lately the Grashof medal from Germany. He was honorary member and past president of the American Society of Mechanical Engineers, and honorary member of the American Association for the Advancement of Scienc.

He was one of the most lovable of men, always the same, a perfect gentleman. He was the soul of honor. His private life was pure. His honesty and integrity were unquestioned. During an intimate acquaintance of 47 years I never heard from any one any statement that reflected in any way upon his honesty or his upright character. I think without question he will go down through history as a peer for high character among business men of his time. His home life was ideal. His good wife was never forgotten either when he was at home or when absent, and every evening at a pre-arranged time, unless the ocean separated them, the telephone was always brought into use for their evening greetings. He was preeminently a true and devoted husband to his dear wife and a loving father to his idolized son. His family and all of his friends will feel their loss in his death more and more as the years go by and they will realize that never in this life will they find his equal.

S. T. WELLMAN

CLEVELAND, OHIO,
April 6, 1914

BIOLOGICAL STATION WORK AT THE UNIVERSITY OF WISCONSIN

THE University of Wisconsin will open its biological station to investigators from June 15 to October 1, 1914. During the regular university summer session, courses will be offered in general zoology, general botany, heredity and eugenics, evolution, field zoology, teaching of zoology, dendrology, morphology of algæ,

mosses and ferns, morphology of algæ, seed plants, plant physiology.

Professor M. F. Guyer will have charge of the zoological laboratories, Professor A. S. Pearse will give the field work. Mr. Nathan Fasten and Mr. A. R. Cahn will assist in the general zoological and field courses. Professor H. R. Denniston will direct the botanical work, and the other instructors in this department will be Professor E. M. Gilbert, A. Stewart, W. N. Steil, E. T. Bartholomew, H. E. Pulling and J. P. Bennett.

The city of Madison is admirably located for a biological station. It is surrounded by three beautiful lakes and the adjacent country affords a variety of swamps, marshes, streams, woodlands and prairies. The station therefore offers excellent opportunities for outdoor biological work with all the advantages that go with the equipment of a large university.

For years surveys and investigations on the lake flora and fauna and their conditions of life have been in progress under the auspices of the Wisconsin Biological and Geological Survey, which has its headquarters in the biological laboratory at the university, and the result of these studies will prove of great value to all who are interested in limnology.

A thirty-foot launch capable of carrying a class of twenty-five has just been purchased and will be in commission throughout the summer. An adequate equipment of row boats, nets, seines and other limnological apparatus is also available.

PACIFIC ASSOCIATION OF SCIENTIFIC SOCIETIES

The fourth annual convention of the Pacific Association will be held at the University of Washington, May 21–23, 1914. The following are the constituents and their secretaries:

Technical Society of the Pacific Coast, Otto von Geldern, 865 Pacific Bldg., San Francisco.

The Cordilleran Section of the Geological Society of America, G. D. Louderback, University of California.

The Seismological Society of America, S. D. Townley, Stanford University.

Pacific Coast Branch of the American Historical Associations, W. A. Morris, University of California.

The Pacific Slope Associations of Economic Entomologists, W. B. Herms, University of California.

Pacific Coast Paleontological Society (special meeting), C. A. Waring, Box 162, Mayfield, Cal.

The Philological Association of the Pacific Coast, G. Chinard, University of California.

The Cooper Ornithological Club (not meeting), T. S. Storer, University of California.

California Academy of Sciences (not meeting), J. W. Hobson, 343 Sansome St., San Francisco.

Biological Society of the Pacific Coast, H. B. Torrey, Reed College, Portland.

California Section of the American Chemical Society, B. S. Drake, 5830 Colby St., Oakland.

Astronomical Society of the Pacific Coast (not meeting), D. S. Richardson, 748 Phelan Bldg., San Francisco.

The Geographical Society of the Pacific (not meeting), J. Partridge, 316 Bush St., San Francisco.

Puget Sound Section of the American Chemical Society, R. W. Clough, 4145 Arcade, Seattle.

San Francisco Society of the Archeological Institute of America (not meeting), O. M. Washburn, University of California.

San Francisco Section of the American Mathematical Society, Thos. Buck, University of California.

The following societies will also meet with the Pacific Association:

Seattle Society of the Archeological Institute of America.

The Oregon Section of the American Chemical Society and the Inter-Mountain Section of the American Chemical Society will join with the Puget Sound and San Francisco Sections.

The LeConte Club will hold its annual meeting and dinner.

Political Scientists will hold a meeting for a program and for the preliminary steps in the organization of a Pacific Coast Branch of the American Political Science Association.

The Northwest Society of Engineers will participate in the meeting of the Technical Society of the Pacific Coast.

The Northwest Association of History, Government and Economic Teachers.

Friday evening will be devoted as usual to the dinners of the constituent societies. Saturday evening will be devoted to the general session of the Pacific Association. At this meeting an address of welcome will be given by

Acting President Henry Landes, of the University of Washington, and three papers of a general scientific interest will be given by three members of the constituent societies.

The railroads have granted the usual convention rates for the convention covering the states of California, Oregon, Washington, Idaho and British Columbia.

The proposal for the transfer of the Pacific Association to the American Association for the Advancement of Science as its "Pacific Division" made at the Berkeley meeting in 1913 resulted in the appointment of committees to consider the plan. During the year the two committees have been at work; the general policies and plans of merging have been agreed upon, and at present a smaller committee is drafting a constitution. It is hoped that the transfer can be made at the Seattle meeting.

SCIENTIFIC NOTES AND NEWS

DR. W. W. KEEN, of Philadelphia, has been elected president of the Fifth International Congress of Surgeons to be held in Paris in 1917.

THE Bruce Medal of the Astronomical Society of the Pacific has been awarded to Dr. O. Backlund, of Poulkova.

THE septennial award under the Acton Endowment has this year been made by the Royal Institution to Professor C. S. Sherrington, Wayneflete professor of physiology in the University of Oxford, for his work on "The Integrative Action of the Nervous System."

AFTER twenty-one years of connection with the Yerkes Observatory, Sherburne Wesley Burnham, professor of practical astronomy, will retire from active service on July 1.

THE seventieth birthday, on March 25, of Professor Adolf Engler, the director of the Royal Botanic Garden and Museum at Dahlem, near Berlin, was celebrated in the presence of many eminent German and foreign botanists, by several functions. According to the account in *Nature*, on the day itself, Professor Pax, rector of the University of Breslau, with Professors Diels and Gilg, as its editors, presented to Professor Engler a copy of the *Fest-Band* of Engler's "Botanische Jahrbücher." The volume forms a supplement to the fiftieth volume of this publication, and consists of more than forty illustrated contributions, largely from his pupils. Professor Haberlandt presented Professor Engler, on behalf of hundreds of subscribers, with his life-size marble bust, the work of the sculptor, A. Manthe. On March 26 there was a banquet at which the official world was represented; and on March 27 the monthly meeting of the Deutsche Botanische Gesellschaft was converted into an "Engler" meeting, and Professor von Wettstein gave, by special invitation, a lecture on the phylogenetic evolution of the Angiosperm flower.

DR. JULIUS KOLLMANN, professor of anatomy at Basle, has celebrated his eightieth birthday.

DR. G. T. BEILBY, Professor A. Keith, F.R.S. and Mr. J. Swinburne, F.R.S., have been elected members of the Athenæum Club for eminence in science.

S. ALFRED MITCHELL, Ph.D., director of the McCormick Observatory at the University of Virginia, has been appointed Ernest Kempton Adams Research Fellow of Columbia University for 1914–15. Professor Mitchell is carrying on work in the measurement of stellar parallaxes by the photographic method.

PASSED ASSISTANT SURGEON MARSHALL GUTHRIE, U. S. Public Health Service, has been appointed chief quarantine officer for the Panama Canal Zone.

SIR HOWARD GRUBB, F.R.S., has been appointed scientific adviser to the Commissioners of Irish Lights, in succession to the late Sir Robert Ball, who held the position for the past twenty years.

SURGEON JOSEPH H. WHITE, of the U. S. Public Health Service, now stationed in New Orleans, has been given a leave of absence for one year to take up for the Rockefeller Commission, the work of the eradication of hookworm disease in Central and South America.

THE Jacksonian Prize of the Royal College of Surgeons for 1913 was awarded to Mr. J.

Howell Evans, F.R.C.S., for his essay on malformations of the small intestine. The subject for the year 1915 will be "Congenital Dislocations of the Joints."

PROFESSOR NORMAN WILDE, head of the department of philosophy and psychology at the University of Minnesota, has been granted a year's leave of absence. Professor David Swenson will act as chairman of the department during Professor Wilde's absence.

DR. LEO M. BAEKELAND has been appointed first lecturer upon the Charles Frederick Chandler foundation of Columbia University. Dr. Baekeland's lecture will be given at the University on May 29 in connection with the celebration of the fiftieth anniversary of the founding of the School of Mines.

PROFESSOR BERGSON began his Gifford Lectures on "Human Personality" in Edinburgh on April 21.

A LECTURE on "Kilauea in Action" was given to the Sigma Xi Society of Case School of Applied Science, Cleveland, Ohio, on April 6, by Dr. A. L. Day, director of the Geophysical Laboratory at Washington, D. C.

PROFESSOR FRANCIS E. LLOYD, of McGill University, delivered a lecture on the subject "The Artificial Ripening of Fruit," on April 4, before the Royal Canadian Institute of Toronto; and, on April 14, before the Clinical Society of the Western Hospital of Montreal on "Colloids and the Ultramicroscope."

DR. SHOSUKE SATO, president of the College of Agriculture of the Northeast Imperial University of Japan, is giving his series of lectures on "Fifty Years of Progress in Japan" at the University of Illinois during the two weeks from April 14 to 24. Dr. Sato, it will be remembered, is the second lecturer from Japan in the exchange of lecturers between the United States and Japan.

ON March 27, Mr. N. S. Amstutz, research engineer, Valparaiso, Indiana, lectured to the Civil Engineering Society of Valparaiso University on photo-telegraphy.

AT intervals of two weeks during the months of February and March, Dr. W. P. Kelley, of the Hawaii Experiment Station, delivered a series of four lectures on soils and soil fertility before the agricultural students of the College of Hawaii at Honolulu.

A BRONZE medallion of the late Dr. John S. Musser, the work of Dr. R. Tait McKenzie, was unveiled in the University of Pennsylvania Hospital on April 15. Dr. George E. de Schweinitz made the presentation address.

THE students and members of the faculty of New York University and Bellevue Medical College held a memorial service in honor of Dr. Egbert Le Fevre on April 5. Addresses were made by Drs. George Alexander, Elmer Ellsworth Brown, Abram A. Smith, George D. Stewart, Edward D. Fisher and Professor John A. Mandel. Resolutions were passed in recognition of the high esteem in which Dr. Le Fevre was held.

PLANS are being made to erect in Lincoln Park, Chicago, a monument in memory of Dr. Nicholas Senn, the distinguished physician.

A PORTRAIT of James Gates Percival, Yale, '15, the poet and geologist, has been presented to Yale University by Harvard University.

ALFRED NOBLE, chief engineer of the Pennsylvania Tunnel and Terminal Railroad Company and a former President of the American Society of Civil Engineers, has died at the age of seventy years.

DR. S. M. JÖRGENSEN, director of the Carlsbad laboratory for chemistry and plant physiology has died in Copenhagen, at the age of seventy-six years.

DR. JACQUES HUBER, director of the Musen Goeldi, Pará, Brazil, died on February 18, in his fifty-sixth year.

THE death is announced, at the age of eighty-one years, of Mr. G. Sharman, for more than forty years paleontologist to the Geological Survey of Great Britain.

THE Honorable Francis Albert Rollo Russell, known for his contributions to meteorology, died on March 30, aged sixty-five years.

Nature says: "By the death of Mrs. Huxley on March 5, in her eighty-ninth year, an-

other link with the scientific society of the latter half of the nineteenth century has been snapped. All who had the happiness of knowing Huxley intimately are aware of the reliance which he at all times reposed on the advice and judgment of his lifelong helpmate. Not only in all domestic concerns, but in questions of literary criticism and even of scientific procedure, he never took a step without consulting her, and her wide knowledge and keen literary instincts made her aid invaluable to him." Mrs. Huxley wrote poems and stories, and prepared a selection from Huxley's writings, "Aphorisms and Reflections from the Writings of T. H. Huxley."

THE U. S. Civil Service Commission announces an examination for associate physicist, qualified in engineering, to fill a vacancy in the Bureau of Standards at Pittsburgh, Pa., at a salary ranging from $2,200 to $2,700 a year, and a vacancy in the Bureau of Standards, at Washington, D. C., at a salary ranging from $2,200 to $3,000 a year.

THE money subscribed in connection with the jubilee celebration of Dr. A. Auwers has been handed over to the Berlin Academy for the foundation of a Bradley Prize, to be awarded once every five years.

WE learn from *The Scottish Geographical Magazine* that the first number of the *Zeitschrift für Vulkanologie,* edited by Herr Immanuel Friedlaender of Naples, and devoted to problems connected with volcanoes or volcanic action, and to appear at irregular intervals, has been issued. In his preface Mr. Friedlaender explains that he has been endeavoring for some years to found an international volcanic institute at Naples, but has met with many difficulties, financial and other. He has therefore established a private institute on a modest scale, and in connection with it is issuing the new journal, which is to contain both original contributions and summaries and abstracts, etc. The first number contains several original papers, the four languages of English, German, Italian and French being all represented. There are a number of fine illustrations, both of Vesuvius and of other volcanoes.

THE interest that has recently been manifested in radium has created a public demand for information both practical and theoretical in regard to the mineral deposits from which it is derived. A short report by Edson S. Bastin on the "Geology of the Pitchblende Ores of Colorado," recently issued by the U. S. Geological Survey, deals mainly with the geology, mineralogy and origin of these deposits, their practical utilization having been treated somewhat fully in other publications. The quantity of uranium ores mined in the United States is exceedingly small, and the great bulk of it, from Utah and southwestern Colorado, does not carry pitchblende but contains the brilliant yellow uranium mineral carnotite. The small pitchblende production of this country is all from the one locality described in this report, in the heart of Gilpin County. It occurs as a constituent of mineral veins which were first worked for their gold and silver content and which still yield important amounts of these precious metals. It is notable that the only other localities in the world where pitchblende has been found in important quantities in mineral veins are the Erzgebirge (in Bohemia and Saxony) and the Cornwall district (in England). Its mode of occurrence in these countries is also described by Mr. Bastin.

ARRANGEMENTS have been made between the New York State College of Forestry at Syracuse University and the Palisades Inter-state Park Commission whereby the college will prepare and carry out a plan of management for the 14,000 acres of forest land controlled by the commission and lying along the Hudson River. The work of getting the forest land into shape will be started about the middle of August by four advanced students under the direction of Professor Frank F. Moon, of the College of Forestry, who was forester for the former Highlands of the Hudson Forest Reservation. The various properties will be mapped out and cruised to ascertain the amount of timber now standing and the amount to be removed. In addition, the fire problem will be studied and eventually a long term reforesta-

tion plan put into force. Centers of insect and fungus damage will be located and timber will be marked so that during the coming winter the park employees will be busy removing the dead, diseased and undesirable specimens. A forest nursery will be developed and active reforestation begun in 1914.

THAT balsam fir, a tree which a few years ago was considered of little value, is now in demand for pulp wood, is the statement made by the Department of Agriculture in a bulletin just issued on the subject. This demand has been brought about, says the department, by the enormous expansion of the pulp industry during the past two decades, with its present consumption of three and a quarter million cords of coniferous wood and the consequent rise in the price of spruce, the wood most in demand for paper-making. In addition, the department goes on to say, balsam has begun to take the place of spruce for rough lumber, laths and the like, as the price of the latter wood has risen. The chief objection to the use of large amounts of balsam fir in the ground-pulp process of paper-making is said to be due to the so-called pitch in the wood, which injures the felts and cylinder faces upon which the pulp is rolled out. Balsam fir does not have a resinous wood, and the material which gums up the cylinder probably comes from grinding balsam under conditions adapted to spruce wood. Yet from ten to twenty-five per cent., and possibly more of balsam can be used in ground pulp without lowering the grade of the paper produced. It is known that with balsam logs left lying in water over a season this drawback practically disappears. In chemical pulp, produced through the action of acids, these acids are known to dissolve the pitch, and any amount of balsam can be used, though some claim that too much balsam in the pulp gives a paper that lacks strength, snap and character. At the present time, balsam fir furnishes about six or seven per cent. of the domestic coniferous wood used by the country's pulp industry. The tree itself constitutes, numerically, about twenty per cent. of the coniferous forest in northern New York and Maine, and is abundant in many parts of New Hampshire, Vermont, and in the swamps of northern Michigan, northern Wisconsin and Minnesota. It readily reforests cut-over areas, and attains a size suitable for pulp wood in a short time. Under present methods of cutting, balsam fir is said to be increasing in our second-growth forests at the expense of red spruce, and with the gradual decline in the supply of the latter wood the fir will become more and more important commercially.

UNIVERSITY AND EDUCATIONAL NEWS

THE faculty of the graduate school of Cornell University has voted to recommend to the board of trustees that Dr. J. E. Creighton, professor of logic and metaphysics, be elected dean to succeed Dr. Ernest Merritt whose resignation takes effect in June. The recommendation by the faculty is virtually equivalent to election. Two years ago President Schurman, in a report to the trustees, proposed that the faculties of the graduate school and the college of arts and sciences be permitted to choose their own deans and the trustees approved the suggestion. Last year the faculty of the college of arts and sciences did select a dean, in the person of Dr. E. L. Nichols, professor of physics.

DR. GEORGE L. STREETER, professor of anatomy in the medical department of the University of Michigan, has been appointed professor of embryology in the Carnegie Institute of Embryology, of the Johns Hopkins Medical school.

PROFESSOR CHARLES MCMILLAN, professor of civil engineering at Princeton University since 1875, has retired and been appointed professor emeritus.

DAVID CAMP ROGERS, Ph.D., associate professor of psychology at the University of Kansas, has been appointed professor of psychology at Smith College.

MR. WILFRED JEVONS has been appointed junior lecturer and demonstrator in physics, and Mr. A. E. Barnes lecturer in materia medica, pharmacology and therapeutics at Sheffield University.

DISCUSSION AND CORRESPONDENCE

PRIORITY OVERWORKED

HAVING personally been a consistent advocate and practiser of the generally accepted rules of priority, for about fifty years,[1] I have no desire to criticize those who have, in recent years, taken up the subject reasonably and temperately, but it is possible in this, as in most other things, to overdo the matter. My objections to some of the recent rulings and applications of the rigid priority rule are threefold:

First: I believe that the rejection of obviously obscene names should be enforced regardless of priority. This has been done by many excellent writers.

Second: Names that have been pirated or stolen from one author by another should be rejected, if the dishonesty can be clearly shown. The cases of this kind are fortunately not numerous, but some are surprising. Such names should not be allowed to pass current any more than counterfeit money or forged checks.

Third: Names of species so badly described that they can not be identified with reasonable certainty should be rejected, especially if no type is preserved. The writings of Linné and other early writers contain many such species. The arbitrary decision of any committee does not alter the case, unless new evidence be given.

To illustrate the second proposition, I will cite a case within my personal knowledge, only omitting names and dates, for obvious reasons, although the incident is not very recent and the parties personally interested are mostly dead.

In this case two eminent and able naturalists and experts, equally interested in the same subjects, attend the meeting of a learned society. Mr. A. reads a paper announcing the discovery of a remarkable new genus and species, say of vertebrates, giving it a MS. generic and specific name. In the description entirely new anatomical terms had to be defined. Mr. B. listens and takes notes. Within a few days B. publishes, in a scientific journal, the discovery of the identical genus and species as his own, and gives it a new name, with no reference to A. His description precedes that of A. by, say, two weeks. The former description is practically the same as the latter, only abbreviated, and even the same newly coined anatomical terms are used, thus proving that the description was a stolen one. Moreover, it afterwards develops that B. had never even seen a specimen of the creature thus described.

Under such circumstances, would the International Committee decide that the pirated descriptions and false names should be adopted in place of those of the real author?

It would be a delicate matter, perhaps, for colleagues to place before the committee requisite evidence in such a case, if recent; but if it were done, what would be the decision? Evidently under the rigid rules of priority, the names given by B. would be upheld, and later on A. would be wrongly accused of copying from B. and changing his names!

Such things have happened more than once, as many zoologists know. Again, suppose that Professor X. is monographing a large collection, say of insects, in his laboratory, to which his assistants and students have access, as is usually the case, and that one of the young men, Mr. Y., looks over his notes, lists or preliminary labels, and then publishes, without permission, the new names of genera and species in some unimportant local list of his own, without descriptions or figures, merely saying that "Professor X., in his forthcoming work, is going to describe such and such genera, with this and that species as types"; and suppose, further, that when Professor X. does publish his work he does not recognize the previous work, and uses entirely different types for the same generic names. Whose

[1] As an evidence of my earlier sentiments, I would call attention to the fact that in 1869 (*Am. Jour. Science*, Vol. XLVII., pp. 92–112), I reprinted the 1845 British Association "Rules of Zoological Nomenclature," with personal notes and suggestions, as footnotes, nearly all of which have been subsequently approved. See also same *Journal*, Vol. III., 1872, p. 387.

names, in such a case, should be adopted? Mr. Y. has pirated the names, but they are in print and have priority. My opinion is that they should be rejected as stolen goods.

This is not an imaginary instance, and such cases have happened more than once. Mr. Y., in such a case, may be thoughtless, rather than criminal, but the resulting confusion in nomenclature is the same.

It seems to me that the case of Fr. Weber, 1795, *versus* Fabricius, 1798, concerning the genera of Crustacea, is a case of just about this sort, yet the committee has decided in favor of the obscure and rare pamphlet of Weber, as against the important work of Fabricius, from whom the generic names were apparently stolen, or improperly borrowed, for Fabricius did not adopt or recognize many of the genera in the forms prematurely published. To adopt the pirated generic names is to throw crustacean nomenclature into much confusion.

If the unauthorized publishing of scientific names is to be upheld as valid, then a reporter for any newspaper or magazine who chooses to report technical papers and note down the names used in a meeting of a learned society may have to be quoted as the author of the names, whether rightly or wrongly spelled. I could give cases of this kind, but it is best to forget them, no doubt, for somebody might revive them, as valid publications.

To illustrate the first and third propositions we may take up an article by Professor J. Playfair McMurrich, "The Actinaria of Passamaquoddy Bay, with a Discussion of Their Synonomy."[2]

In this article the author tries to restore certain names given by Linné to some obscure Norwegian species, in place of those almost universally adopted by European and American writers for some of the best known species common to both coasts.

He brings forward no evidence that has not been well known to nearly all writers on the subject. He himself admits that the descriptions given by Linné are insufficient to identify any species, and he therefore depends on the references made by Linné later (in edition XII.) to various earlier writers, as was his habit in many groups. Every one familiar with his work must recognize that he often made such references very loosely, mainly to give some general idea of the looks of a thing, without intending to imply absolute identity. McMurrich picks out certain figures, among several referred to by Linné, that he thinks can perhaps represent the species intended, but he rejects various others, and thus guesses at what Linné had in mind, even when the figures disagree with the descriptions.

In fact, Linné was profoundly ignorant in respect to most marine Invertebrates, except shells. His descriptions of Actinians are no better than an intelligent boy twelve years old could write, after five minutes of watching these creatures, and his references to figures are as careless as his descriptions. Therefore his actinian species should be dropped as indeterminable, even if there were no other good reasons. The leading European authorities, familiar with the actinians of the same region, have never been able to agree as to his species, and they surely ought to have an advantage over an American in such matters.

But this is not the only reason why most writers, before McMurrich, have wisely rejected the names. The most convincing reason has been their obscenity. No writer has been more familiar with north European actinians than P. H. Gosse. In his "Actinologia Brit.," 1860, he quotes both *A. senilis* and *A. judaica* of Linné under *A. dianthus;* and also *A. senilis* and *A. felinia* under *Tealia crassicornis.* But he dismisses these names as entirely "out of the question," on account of their objectionable significance.

Linné gave obscene names to some genera and to many species. These, in many cases, were merely the dirty names given to many marine creatures by the local fishermen and put into a Latin form by Linné or his predecessors. Such obscene names (often the same) are still in use, even by American fishermen, as I know from long experience.

[2] *Trans. Royal Soc. Canada,* Vol. IV., 1911, p. 59.

Once, when I asked the captain of a Cape Ann fishing schooner what names they gave to certain actinians, holothurians, ascidians, etc., he said, "We should not dare to tell our wives and daughters," and I agreed with him. Such are the names that McMurrich and some others would like to revive!

It is rather embarrassing, when asked by an educated lady the name of a beautiful sea-anemone, to have to say that its name is "*Priapus senilis*," or even *Metridium senilis;* or "*Priapus humanus*" Linné, for another creature; or to give other equally unjustifiable names.

That Linné used these and other names in an obscene sense is evident, not only because often derived from fishermen's dirty names, but because he described his species in the terms of human anatomy of sexual organs, in many cases, too absurd to mention.

It is, therefore, unfortunate that a zoologist of such excellent ability as Professor McMurrich, should waste his time trying to revive these old, dirty, indeterminable names, which he himself admits can not be definitely applied to any species by means of the descriptions themselves, while his indirect evidence is equally uncertain. The names that he thus adopts are *Metridium senilis* for *M. dianthus; Urticina felina* for *U. crassicornis; Priapus equinus* for *Actinia mesembryanthemum.*

In the tenth edition of the "Syst. Nat.," 1758, p. 656, the two species of "*Priapus*" are *P. equinus* and *P. humanus.* The latter is a sipunculoid worm. I do not know that any one has recently tried to revive this name. It has better claims than some of the others.

For *P. equinus* the only description (1758) is "semiovalis læviusculus." Surely not very edifying! In Fauna Suecica, p. 510, he has three more species: *P. senilis; P. judaicus; P. felinus.* The first has, as a diagnosis, only this: "subcylindricus rugosus," with a three-line descriptive note, to the effect that it is the size of the last joint of a finger; that it is fuscous, sordid, rough, with a subcoriaceus tunic, with the upper part soft, thin and sanguineous. These characters surely do not apply to *M. dianthus,* which is large, soft and smooth throughout, and especially delicate and translucent, when as small as the one mentioned by Linné. It does not have the upper part sanguineous, however much it may vary in color. There are other species on the Norwegian coast that agree with the brief description far better. This identification by McMurrich is then in itself untenable, as well as undesirable.

As for "*Priapus felinus*," 1761, the case is no better. The diagnosis is "cylindricus lævis glande muricata." The descriptive note is "simillarius priori," "sed glande muricata." No reference to earlier works. What he means by a "muricate glans" is hard to understand, if he had a soft actinian before him, like *Actinia mesembryanthemum.* Perhaps he refers here to another sipunculoid worm.

As for the generic name *Priapus,* 1758, if it is to be used at all, it must be applied to the second species, *humanus,* as the type, for the first species was very early (1767) placed in *Actinia.* Whether helminthologists will adopt the name remains to be seen.

A. E. VERRILL

THE EDUCATIONAL VALUE OF MATHEMATICS

TO THE EDITOR OF SCIENCE: In a speech before the Cincinnati Schoolmaster's Club on February 21, 1914, Professor E. L. Thorndike, of Columbia University, made certain statements with regard to the educational value of mathematics and the classical languages, which were quoted in the issue of the *Cincinnati Enquirer* for February 22. One of the statements as quoted was that

> the old notion that Latin or mathematics made the mind more effective in all the work of business, law or other professions was largely superstition.

The phraseology of this statement is certainly misleading. By the use of the expression "old notion" Professor Thorndike tends to convey the impression that no up-to-date, intelligent person has such a notion. That this is the very reverse of the truth may be seen by quoting from an article by Professor C. J. Keyser in the issue of SCIENCE for

December 5, 1913, entitled "The Human Worth of Rigorous Thinking." Professor Keyser is the head of the department of mathematics at Columbia University, Professor Thorndike's own institution, and is a writer of international repute on mathematical subjects and particularly on the educational value of mathematics. I leave it to any one to judge as to who is better qualified to speak with authority on the subject of mathematics and the pedagogy of mathematics, Professor Thorndike or Professor Keyser.

Professor Keyser says in the course of his paper:

We are beginning to see that to challenge the human worth of mathematics, to challenge the worth of rigorous thinking, is to challenge the worth of all thinking, for now we see that mathematics is but the ideal to which all thinking, by an inevitable process and law of the human spirit, constantly aspires. We see that to challenge the worth of that ideal is to arraign before the bar of values what seems the deepest process and inmost law of the universe of thought. Indeed we see that in defending mathematics we are really defending a cause yet more momentous, the whole cause, namely, of the conceptual procedure of science and the conceptual procedure and activity of the human mind, for mathematics is nothing but such conceptual procedure and activity come to its maturity, purity and perfection.

If Professor Thorndike had read Professor Keyser's paper, of which I have only quoted a brief extract, I doubt if he would have characterized as "superstition" ideas which are so vigorously maintained by one of the men best qualified to speak with authority on the subject in question.

Another statement by Professor Thorndike is that

Mathematics improves mathematical reasoning but not the power to reason in general.

I am yet to be convinced that there is more than one kind of reasoning; whether one reasons in mathematics or in some other subject, he is going through the same process. Mathematics furnishes the best training in reasoning because the student is required to reason more frequently than in any other subject, and because he is always in a position to test the validity of his reasoning by means of exact concepts.

However, I am not writing this letter because the opinion of some of the educational faddists of the day with regard to the educational value of mathematics is a matter of much significance to a mathematician, in itself. I *am* writing it in defense of a rational curriculum in the high schools and the elementary schools. Having received my own preliminary education in the Cincinnati schools, and having had considerable opportunity of late to observe the preparation of students entering college from this community as compared with that preparation some fifteen years ago, I can only deplore the modern tendency to give at most a superficial attention to fundamental subjects, and to divide the student's energy and attention among a multitude of subjects in such a manner as to create in his mind hopeless confusion and to prevent his having really definite ideas about anything in particular.

The teachers in the high schools and the elementary schools are working just as hard as ever, are just as efficient as ever, but they can not obtain as good results under the handicap of present-day curricula. The student can not be trained to think in as effective a manner as he was fifteen or twenty years ago, under present circumstances. And I believe any reasonable person will agree that the primary object of education is to teach the student to think, whether he is going to enter college or is going out into the world at the end of his high-school course.

But those who have been most responsible for this unfortunate state of affairs in the high schools and the elementary schools, far from realizing the work of destruction that they have already done, are now endeavoring to complete it by attacking what is left of valuable educational training in the curricula of to-day. It is high time that those who see the danger of this movement, and I know there are many, make a resolute stand against it. If such statements as those of Professor Thorndike are allowed to go unchallenged, and thus

to appear to the general public as having the weight of authority behind them, there is no telling where we shall be before the inevitable reaction sets in.

Personally I believe that every student who takes a four year course in high school should be required to study the English language during those four years, and at the same time he should be getting some definite knowledge of either mathematics or the classical languages, preferably of both. Distinct vocational training might well be left in the background until the student has had an opportunity to get some real mental training. I know this is the opinion of the great majority of my colleagues at the University of Cincinnati, including Dean Schneider, of the college of engineering, who is a recognized expert on vocational training. And I do not doubt that it is the opinion of the great majority of college teachers throughout the country.

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SEX IN MULTIPLE BIRTHS

IN a copy of lectures delivered by Dr. Raymond Pearl at the 1912 Graduate School of Agriculture at Lansing, Mich., I find the following tables given, indicating that in multiple mammalian births as the numbers per birth increase, the ratio of males to females decreases.

Man

No. Young per Birth	Males per 1,000 Females
1	1,057
2	1,043
3	548

Sheep

3 Males	3 Males; 1 Female	2 Females 1 Male	3 Females
16	39	22	38

In the sheep there are 215 females to 130 males.

It is worthy of note that these data are from normally uniparous species. In swine where the number at a birth may vary from one to twenty-three (in an exceptional instance) this excess of females is not apparent. In 174 litters the number of males per litter and the expectation based on chance, using the relative frequency of the different-sized litters (fourteen per litter being the largest) was as follows:

No. Males per litter	0	1	2	3	4	5
Expectation	3.4	12.8	24.6	33.4	34.7	28.5
Actual	2	13	26	28	31	28
No. Males per litter	6	7	8	9	10	11
Expectation	19.0	10.4	4.6	1.7	0.48	0.11
Actual	21	12	8	2	2	1

This shows but a slight departure from expectation and is within the limits of error for such small numbers. It seems doubtful if there is a tendency toward increased proportions of females in multiparous births. In fact the excess is slightly on the male side here.

In 126 births from various private collie, fox terrier, Scottish terrier and Boston bull terrier records, the following results appear:

No. male pups	0	1	2	3	4	5	6
Expectation	15.1	35.75	37	24.5	10.86	2.8	.3
Actual	14	36	39	22	11	4	0

These statistics give qualitatively the same result. That this accordance with expectation on the basis of chance is not necessarily a property of normal multiple births, is shown by the following statistics on sheep triplets from the Iowa State College flock and two farmers' flocks located near there. The total number of lambings is 146.

	3 Males	2 Males; 1 Female	1 Male; 2 Females	3 Females
Expectation	18.25	54.75	54.75	18.25
Actual	21.00	56.00	51.00	18.00

This gives 226 males and 212 females. The smallness of these numbers does not conclusively indicate that influences other than mere chance do not operate, but they are interesting since they give opposing evidence on the point discussed by Dr. Pearl.

EDWARD N. WENTWORTH
CHICAGO VETERINARY COLLEGE,
July 26, 1913

SCIENTIFIC BOOKS

Biochemie der Pflanzen. Von Dr. Friedrich Czapek, Professor der Anatomie und Physiologie der Pflanzen an der K. K. Deutschen Universitaet in Prag. Zweite, umgearbeitete Auflage. Erster Band, pp. xix., 828, mit 8 Abbildungen im Text. Verlag von Gustav Fischer, Jena, 1913. M. 24.00, geb. M. 25.20.

In reviewing a recent foreign treatise on organic chemistry, one of our best chemists, who is also very favorably known as an investigator, made the remark that it was so much more difficult to teach organic chemistry to-day than it was a generation ago, apparently for the reason that the field to be covered is so much greater now than it was then. Recently a graduate student, who was attending a course of lectures on organic chemistry by way of review, made the statement that in the course of his college career he had heard a number of organic chemists lecture and that while their method of presenting the subject differed in each case, the lecturer had invariably introduced his topic by stating that he did not expect his students to learn something about each of the hundred thousand and some odd tens of thousands of organic compounds catalogued in Beilstein and its supplements. It would seem that some of the horror which so many students experience, or at least feign to experience, at the number of organic compounds when they first approach the subject, is due in part at least to their teachers. While we profess that we are not frightened by the numbers of carbon compounds and inform our students at the outset that they need not be horror-stricken by any such mass action, yet we seem to feel, and even proclaim that, because of the enormous strides made by organic chemistry, we need more time than formerly to cover the ground though but in an elementary fashion. If, *e. g.*, we measure the growth of organic chemistry by the ten thousand or more carbon compounds that have been added to our catalogue in a given period, then indeed our point of view must make us pessimistic as to the ultimate outcome of our success as teachers of the elementary part of our subject in any rational allotment of time at our disposal during the college quadrennium.

Any organic chemist who has reached middle age may well appreciate the mental state of chemists of the old school who found themselves confronted by Kekulé's structural theory. But, if they were confounded it was due, not so much to the rapid growth in the number of compounds that resulted from the application of Kekulé's views, as from the different mental attitude that the structural theory demanded. The Grignard reaction, though in short space it has produced thousands of new compounds at a time when the progress in organic chemistry was referred to as having become sluggish, wrought no visible disturbance whatever for the simple reason that it brought no new fundamental theories into play, hence made no demands on our mental attitude toward the subject. Any one who has studied the life of Liebig carefully must have noticed that underneath the surface there was something more than dissatisfaction toward the university administration that caused him to leave Giessen. The theory of substitution was revolutionizing organic chemistry in spite of Liebig's attitude and in spite of the "S. C. H. Windler" which Woehler hurled at the French chemists. But whereas Woehler adapted himself as well as he could and stuck to his post and his "Fach," Liebig found it more convenient not only to migrate, geographically speaking, but to "umsteigen"—if this apt expression by Mark Twain may be permitted in so serious a topic as this—or to "umsatteln" if a German phrase when applied to the change of a German chemist from the pure to the applied seem preferable.

The structural development of organic chemistry has made it possible to treat the subject-matter deductively rather than inductively. The claim of inductive treatment in science has become a sort of fetish. We have preached this doctrine to such an extent to our students that we dare not admit that

our method of procedure after the first or second lecture is largely deductive. If in organic chemistry we have the courage to be outspokenly deductive from the start and insist on its logical consequences, half of the battle is won. To be sure there are still a sufficient number of difficulties to be overcome, but they do not consist in numbers, but rather in the possibility of acquiring the right mental attitude.

To a large extent plant chemistry is organic chemistry. However, whereas most of the new organic compounds that are produced synthetically find a convenient place in the well-regulated drawing room of organic chemistry, most of the new substances isolated from the vegetable kingdom—and many of the old timers from the same source—still belong to the lumber chamber of organic chemistry.

It is true that organic chemistry consists of something more than the study of the physical and chemical properties of chemical individuals containing all the way from one to a host of carbon atoms. Modern organic chemists with adequate physico-chemical training appear but too anxious to rub this fact into their older colleagues. This is equally true of the organic chemistry of the vegetable kingdom, but to a much greater degree. The "Grundlagen und Ergebnisse der Pflanzenchemie" by Euler, one part of which consists of a briefly descriptive catalogue of the *materia phytochemica* and two parts of which are a text on physical chemistry with occasional phytochemical application, are but a partial expression of the truth of the above assertion. Great as has been the development of physical chemistry, more particularly since Ostwald "made school" at Leipzig, it has scarcely begun to explain the problems of the "Biochemistry of the Plants," though it has touched upon this subject at innumerable points. Whereas the application of structural chemistry to the *materia phytochemica* has made possible a large amount of systematization and has thus simplified the situation, physical chemistry has thrown but dim light on innumerable spots. The status of the application of physical chemistry to biochemical problems is approximately that of the status reached in organic chemistry when Berzelius characterized the discovery of the benzoyl radicle by Liebig and Woehler as the dawn of organic chemistry. Daylight is beginning to dawn in the study of biochemical problems, but before daylight appears much more generalization will have to be made possible, not only by the extension of present physico-chemical methods over a large field, but by a much better understanding in each and every department of biochemical research. The single chapter of catalysis, always a convenient word to cover our ignorance, and its application to enzyme action is sufficient illustration.

To attempt to write a comprehensive biochemistry of plants under present conditions is a stupendous undertaking. The mere cataloguing of the constituents of plants as attempted by Wehmer in his "Pflanzenstoffe" for the Phanerogams has proved sufficiently burdensome to discourage even the most ardent compiler. Hence one is not surprised to learn that Czapek has gladly availed himself of the opportunity to unload a part of this work, as undertaken in the first edition, by referring his readers to Wehmer for more complete data so far as the constituents of phanerogams are concerned. Yet in spite of this limitation, the first volume has grown enormously. If it is more of a true biochemistry than was the corresponding volume of the first edition, this is due not so much to this sort of unburdening as it is due to the greater attention and more space given to general considerations. Readers of this review who have been accustomed to resort freely to the first edition for information may be interested to compare the figures given in the following outline of the contents of the second edition with the corresponding figures of the first. At the same time the following data will give a better idea of the contents to those not already acquainted with Czapek.

Preceded by a short historical introduction of nineteen pages, the contents of the volume are classified under two general heads, viz.,

General Biochemistry (pp. 20 to 240) and Special Biochemistry (pp. 240 to 820). The first part is subdivided into four chapters:

1. The substratum of the chemical changes in the living organism, the protoplasm (pp. 20 to 65).

2. The chemical reaction in the living plant organism (pp. 66 to 146) including such topics as the conditions of the reactions, the time element, catalysis, enzymes, immunity.

3. Chemical stimulation (pp. 147 to 233) including growth in all of its aspects.

4. Phenomena of chemical adaptation and inheritance (pp. 234 to 239).

The subject-matter under special biochemistry is arranged into parts, divisions and chapters. Part I. deals with Saccharides and the rôle which they play in plant metabolism (pp. 240 to 708). The "general division" discusses the vegetable sugars. The "special division" takes up the following subjects in as many chapters:

5. The sugars and carbohydrates in fungi and bacteria.

6. The resorption of sugars and carbohydrates by fungi and bacteria.

7. The carbon assimilation and sugar formation by fungi and bacteria.

8. The carbohydrate metabolism in the Algæ.

9. The reserve carbohydrates of the seeds.

10. The resorption of sugar and carbohydrates in the germinating seeds.

11. The formation of reserve carbohydrates in the seed.

12. The carbohydrate metabolism in underground reserve organs.

13. The carbohydrate metabolism in shoots and leaf buds.

14. The carbohydrate metabolism in foliage leaves.

15. The carbohydrate metabolism in the reproductive system.

16. The carbohydrate metabolism in phanerogamic parasites and saprophytes.

17. Resorption of carbon compounds by means of the roots and leaves of phanerogams.

18. Secretion of sugar and carbohydrates.

The phytochemical synthesis of sugar in the chlorophyll receives an exhaustive treatment (pp. 506 to 628). The subject of saccharides as skeleton substances of the plant body is similarly treated.

Part II., the last part of the first volume, is devoted to the lipoids in plant metabolism, which subject is treated under two principal heads: the nutritive lipoids and the cytolipoids. Under the former head we find,

22. The reserve fats of the seeds.

23. The resorption of fats during the germination of the seed.

24. The formation of fats in ripening seeds and fruits.

25. Reserve fats in stems, etc., and foliage leaves.

26. Fat as reserve material in thallophytes, mosses, ferns and pollen grains.

Under the head of cytolipoids the following subjects are discussed:

27. Vegetable lecithines (phospholipoids).

28. Vegetable cerebrosides.

29. Sterinolipoids of plants.

30. Vegetable chromolipoids.

31. The production of wax (cerolipoids) in plants.

Thus it becomes apparent that volume one, although it has greatly increased in size, considers but two groups of phytochemical substances and the biological problems which they suggest. If the chemistry of the simple saccharides has been in a fairly satisfactory condition since Fischer paved the way to a better understanding, we must not forget that we have but entered the vestibule of a carbohydrate chemistry and that the problem of the photosynthesis of the simplest sugar has not yet been solved to the complete satisfaction of the physiologist.

It has evidently been the endeavor of Czapek to bring together the available information on a given subject and to classify the information as indicated by the chapter headings quoted above. This manner of treatment does not make a good text-book, but with the extensive references to original literature

it makes an admirable reference book. Czapek has also refused to assume the rôle of arbiter, but quotes, with as little prejudice as can be expected, the opinions of each individual, leaving it to the reader to arrive at his own conclusion.

In closing, a single allusion to the greater importance that is being accorded to phytochemistry in recent years may not be out of place. For more than a generation after the announcement of the benzene theory by Kekulé, organic chemists could think of little else than synthesized substances and of coal tar as their gold mine. So one-sided were they at times that they did not even see the element of the ridiculous in the suggestion to make foodstuffs artificially from this source. The other extreme has now been reached by the pure-food chemist who by big head lines in the newspapers and the waving of red rags before large audiences denounces this same coal tar as the source of everything that is bad. A much more common sense reaction has been started by those chemists who have been pointing out how the intricate process of the plant laboratory may be husbanded for the benefit of mankind by farmers who need not be Ph.D.'s but who have been taught by the biochemist to make the most of their opportunities.

Again, while we should welcome the new synthetic remedies that have been turned out by the "Farbenfabriken" of the fatherland, we should not forget that in this field also the plant still produces valuable remedies which we can obtain as well or better from living or recently dead plants than as a by-product from fossilized plants of former geological ages.

But aside from the agricultural and pharmaceutical or medical aspects which the chemical study of plants and plant life may afford, the study of these subjects for its own sake has a charm all its own. Who can view the beautiful color of the flowers or inhale their perfume without feeling that a knowledge of the processes by which the plant produces these physiological effects on the intelligent animal is in itself worth knowing though the pigment never be used to dye a fiber, nor the perfume be extracted in order to find a place on my lady's toilet table

Edward Kremers

A History of Land Mammals in the Western Hemisphere. By William Berryman Scott, Blair Professor of Geology and Paleontology in Princeton University. New York, The Macmillan Company, 1913. Pp. i–xiv + 1–693, with frontispiece and 304 text-figures.

In this striking volume Professor Scott has striven to assemble and set before the lay reader a judicious selection from the great accumulation of facts which the many students of mammalian paleontology have discovered. The presentation of the subject is essentially different from that of Professor Osborn's "Age of Mammals" wherein the rise and spread of faunas are treated as a succession of historical events. In the present work, after certain introductory chapters, the treatment is zoological, the life history of each of a number of important orders being discussed from beginning to end. Thus the two works by two of the foremost American paleontologists are supplemental; collectively they give a complete picture of Tertiary time.

The first two chapters of Professor Scott's book acquaint one with the methods pursued by the student of past life, the one showing the way whereby the geological data are interpreted, and the other the methods of paleontological research—how animals are preserved from the remote past, the nature of the remains, the way in which the characters they show are explained, and the method whereby the animal is reconstructed as a living being. A chapter on the principles of taxonomy is concluded by a full mammalian classification which is almost identical with that given by Professor Osborn in the "Age of Mammals," the only differences being relatively unimportant. The discussion of the skeleton and teeth of mammals, so essential to an understanding of fossil evidence, is followed by a chapter on the principles of geographical distribution of mammals and a summary of the successive mammalian faunas.

The succeeding chapters elucidate the histories of the principal orders: the Perissodac-

tyla—horses, titanotheres, rhinoceroses; the Artiodactyla—swine, camels, deer; the Proboscidea; and of the primitive ungulates, the Amblypoda and Condylarthra. There follow a number of chapters devoted to the peculiar South American ungulates, on which Professor Scott is so pronounced an authority, and these give place to a discussion of the carnivores, primates, edentates and marsupials.

Chapter XVIII. is philosophical, in that it expresses very clearly Doctor Scott's ideas concerning the modes of mammalian evolution. He states in explanation of the variations found between the "family trees" that "It is quite impracticable to construct a genetic series without making certain assumptions as to the manner in which the developmental processes operated and the kinds of modification that actually did occur," and the facts upon which these assumptions are based are ascertained by several distinct methods. Of these the oldest is comparative anatomy, an accurate knowledge of which is indispensable to the use of the others. The second is that of embryology, for, while Haeckel's famous biogenetic law, wherein the life history of the individual is supposed to give a résumé of that of the race, is proved not to be implicitly trustworthy for the interpretation of structural features, nevertheless the information attained through study of the embryonic stages is of the greatest service in the solution of zoological problems.

The third method, experimental zoology, especially that part known as genetics, has also taught us much; but the fourth, paleontology, despite the imperfection of the record due to the irretrievable loss of much of the past history of life, nevertheless has the preeminent advantage of offering to the student the actual stages of development, as it preserves the original documents and in the true order of succession.

In summation, Professor Scott remarks: "It is only too clear that the principles as to the modes of mammalian development which can be deduced from the history of the various groups must, for the most part, be stated in a cautious and tentative manner, so as not to give an undue appearance of certainty to preliminary conclusions, which should be held as subject to revision with the advance of knowledge. Much has, however, been already learned, and there is every reason to hope that experimental zoology and paleontology, by combining their resources, will eventually shed full light upon a subject of such exceptional difficulty" (p. 663). A full glossary completes the volume.

The illustrations are in part from photographs of living mammals and clear anatomical drawings of certain essential skeletal features, but what will interest the general reader most are the admirably drawn reconstructions of extinct forms done by R. Bruce Horsfall under the careful supervision of Professor Scott. There are also others by Charles R. Knight, whose work always has a realism which no other artist of the prehistoric has ever attained.

In the production of this work Professor Scott has done a lasting service to the serious student of paleontology, as well as to the lay reader, and it is to be hoped that the admirably conceived and executed volume will have the appreciation it deserves.

Richard S. Lull

Yale University

The Hill Folk. Report on a Rural Community of Hereditary Defectives. By Florence H. Danielson, M.A., and Charles B. Davenport. Eugenics Record Office. Memoir No. 1.

As explained in the preface, this is the first of a projected series which is intended to embody some of the more extended research of the Record Office. Dr. Davenport calls attention to the fact of its primary value to sociologists rather than to students of inheritance traits—which latter will require much more extended study, which, we are assured, will come later.

This Hill Folk study began with pedigrees of some of the inmates of the Monson State Hospital at Palmer, Mass., and extended to a town of 2,000 inhabitants in a fertile valley on a railroad between prosperous cities. The town is frequented by tourists who about

double the population during the summer. A lime kiln and a stone quarry represent the only industries outside of prosperous farming, that are followed. The Hill Folk descended from two men, a shiftless basket maker, known here as Neil Rasp, and an Englishman, owner of a small farm, both of whom came to the settlement about the year 1800. Their descendants have "sifted through the town and beyond it. Everywhere they have made desolate, alcoholic homes which have furnished state wards for over fifty years, and have required town aid for a longer time."

After an explanation of the charts—which are printed in the circular form with lines of descent radiating from the center and oldest generation—and a general survey of the strains involved and their traits, the following topics indicate the methods of study followed, viz., (*a*) inheritance, (*b*) marriage selection, (*c*) financial burden entailed by criminals and dependents (with a comparison with the Jukes), (*d*) survey of the present school children and (*e*) heredity and environment. An appendix takes up a detailed history of the separate families and certain individuals and their characteristics. The usual conventional symbols (American) are employed, though an apparently successful effort has been made to distinguish two degrees of mental deficiency and to indicate the same by the symbols. The members of the higher group, which are indicated by the letter "F" on white background, are able to support themselves in an inefficient "meager way," but "lack ambition, self control, common sense and the ordinary mental and moral capacity for differentiating between right and wrong." The individuals of the lower group, indicated by the symbol on a black background, are incapable of self support and "are a special menace to the community from their lack of all mental and moral stamina."

The symbol "Sx" is applied to the cases only where the "sex impulse works unhindered" from a lack of proper balance between the impulse and self control, as distinguished from those who only incidentally commit a sexually immoral act.

There is considerable data found in this study for comparing the effects of changes of environment.

An excellent lesson is derived from the study of one typical case showing the result of permitting marriage between and propagation of children by a pair of evident defectives. Of eleven children born from this union, all but two, that died in infancy, became public charges. Seven were known to be feebleminded. Two of these and one of the infants that died early were epileptic.

An exceedingly interesting and instructive study is the survey of seventy-five school children from these families. Of these, school records were obtained in all but seven cases. From these the mental characteristics are noted. Thirty-eight are below the grade in which they should be in the schools, and in general they are either unable to fix attention upon one thing long enough to grasp it or require so much time to comprehend ideas that they progress very slowly. Usually they are "quiet, stupid laggards." The aggressive disturbers of social peace, though present, are the exceptions here.

This study of eight hundred and thirty-seven people has involved an immense amount of work on the part of the field worker, Miss Danielson, and has been subjected to a very searching and critical analysis by Dr. Davenport. It is full of interesting material for comparisons, some of which are discussed by the authors; as, for instance, the effects of dispersion of the feeble-minded groups; the attempt to approach the determination of unit mental characteristics; the ultimate cost of early segregation as compared with its neglect, etc.

The following is a brief summary of conclusions given.

"1. The analysis of the method of inheritance of feeble-mindedness shows that it can not be considered a unit character. It is evidently a complex of quantitatively and qualitatively varying factors most of which are negative, and are inherited as though due to the absence of unit characters.

"2. The value of out-marriage, exogamy, as a means of attenuating defective strains is

diminished by the action of social barriers and the natural preference of individuals, which induce marriages among like grades of mentality, in a foreign as well as a native locality.

"3. The amount of town aid which this one group of defective families requires decennially has increased 400 per cent. in the last thirty years. In the same length of time its criminal bill has been $10,763.43 for sixteen persons; and the bill for its thirty children who were supported by the state during the last twenty-three years is $45,888.57. During the past sixty years this community has, it is estimated, cost the state and the people half a million dollars.

"4. Half of the present number of school children from these families who are living at home show evidence of mental deficiency.

"5. One half of the state wards from the community in question have reacted favorably in an improved environment and give promise of becoming more or less useful citizens; the other half consist of institutional cases and those which have not reacted to the better environment, but are likely to become troublesome and dangerous citizens.

"6. The comparative cost of segregating one feeble-minded couple and that of maintaining their offspring shows, in the instance at hand, that the latter policy has been three times more expensive."

Valuable as are the deductions from such a piece of work as this, its greatest value lies in the number of facts collected and recorded, which will always be available for later comparisons in two ways, viz., with any subsequent information concerning the same people, and with collected facts concerning other families and settlement groups as they are being secured in different parts of the country.

A. C. Rogers

The Microtomist's Vade-mecum. A Handbook of the Methods of Microscopic Anatomy. By Arthur Bolles Lee. Seventh edition. Philadelphia: P. Blakiston's Son & Co. Pp. x + 526. 1913.

The appearance of a new edition of this well-known handbook will be welcomed by biologists, many of whom, like the reviewer, have doubtless awaited its appearance with some impatient anticipation. Although entitled a "Handbook of the Methods of Microscopic Anatomy," the field covered is broad, as there are included methods employed by embryologist, histologist, zoologist and botanist. The need the book aims to meet is thus not a simple one. The extensiveness of the field calls for a careful selection from a large mass of material, of standard methods of real value which need to be worked over and personally tested. This the author has in most instances done and hence the greater practical value of the book.

The present edition conforms to the previous one in arrangement, form of presentation and size—this last despite the addition of considerable new matter ("more than 700 new entries in the index"). Indeed, of the thirty-six chapters that make up the book the only ones which are increased in length are those on Embryological Methods (Ch. XXV.) and Nervous System; Cytological Methods (Ch. XXXIII.). The condensation has been secured by "cutting out superfluous matter, condensation of the text and typographical compression." The sections relating to neurofibrils and to blood and blood parasites the author states in the preface have been almost entirely rewritten. Of important additions to histological technique introduced since the previous edition, the author specifically mentions Gilson's mounting media, camsal balsam and euparal, which permit mounting direct from 95 per cent. alcohol, and also improvements in the Bielschowsky and Cajal silver methods.

As in the previous editions, the methods considered by the author more important are presented in larger type, those less important in small type. The references to the original articles are in all instances given and are, as far as the reviewer has tested them, exact.

It would not be difficult in a book of this kind whose excellence depends upon a rigorous selection and personal emphasis, for a worker to cite methods which might well have been included or which seem to merit more

emphasis, such as Wright's blood stain and Mallory's connective tissue stain, the latter not given in its latest form. Hasting's Nocht's blood stain is not mentioned, nor the value and usefulness of formalin with the freezing microtome. Under embryological methods the modeling methods should perhaps have been given more attention, and to the von Wijhe methylene blue clearing method for cartilage might well have been added others such as the alizarin oil of wintergreen and benzyl-benzoate method (Spaltcholtz) and the Schultze caustic potash and glycerin clearing methods for bone and nerves. But when all is said, the emphasis should be placed, not on what has been omitted, but on the large number of standard methods that have been included.

The index is full, cross references are numerous and the typography, paper and binding satisfactory; typographical errors are rare; in fact, the high standard of the sixth edition has been maintained in the present one, which, like those that have preceded it, may be expected to occupy an important place on the table of the practical worker with the microscope in the field of biology.

B. F. KINGSBURY

SEVENTH LIST OF GENERIC NAMES (TUNICATES) UNDER CONSIDERATION IN CONNECTION WITH THE OFFICIAL LIST OF ZOOLOGICAL NAMES

26. Notice is hereby given of the receipt by the secretary of the Commission on Nomenclature of the following communication regarding generic names of tunicates. All persons interested in the matter are cordially invited to submit to the secretary any arguments for or against the proposed action. In accordance with instructions from the International Congress, the secretary is required to give at least one year's notice to the zoological profession before the Commission takes any action involving the acceptance of any name under the plenary power for suspension of rules.

27. In accordance with instructions from the Congress, copies of this notice are sent simultaneously, but without comment, to the following journals: *Bull. Soc. Zool. France, Monitore Zoologico, Nature,* SCIENCE, *Zool. Anz.*

Doliolum, Pyrosoma, Salpa, Cyclosalpa, Appendicularia und *Fritillaria* sind gegen Aenderung zu stützen.

Wir 12 unterzeichneten Tunicatenforscher sind übereingekommen, die 6 genannten Genusnamen pelagischer Tunicaten als gültig anzunehmen. Die Namen dieser Tunicaten werden von jedem Zoologen als vollkommen eingebürgert anerkannt werden, ihr Gebrauch hat bisher niemals zu Missverständnissen Anlass gegeben, die Genera sind Paradigmata in der zoologischen Systematik, sie spielen in der Entwicklungsgeschichte eine grosse Rolle und beanspruchen in der Tiergeographie, Planktonforschung und auch in der Hydrogeographie einem ganz hervorragenden Platz. Eine Aenderung der Namen würde eine schwere Schädigung bedeuten.

(1) *Doliolum* Quoy & Gaimard, 1834.—*Doliolum* ist von Otto 1823 (N. Acta Ac. Leop., v. 11, p. 313) für eine wohl durch *Phronima* ausgefressene *Pyrosoma* aufgestellt worden. Dann ist *Doliolum* von Quoy & Gaimard, 1834 (*Voy. Astrolabe, v. 3, p. 599*) gut beschrieben und jetzt in letzterem Sinne allgemein in Gebrauch. Den bisherigen Regeln nach würde *Doliolum* Synonym zu *Pyrosoma* werden, für *Doliolum* in heutigem Sinne würde ein neuer Name gebildet werden müssen. Der Familienname Doliolidæ würde verschwinden.

(2) *Pyrosoma* Péron, 1804.—1804 beschrieb Péron (*Ann. Mus., Paris, v. 4, p. 440*) *Pyrosoma* und ebenfalls 1804 Bory (Voy. Iles Afr., v. 1, p. 107, nota) *Monophora.* Welcher der beiden Namen der ältere ist, lässt sich nicht feststellen, aber aus Quoy & Gaimard, 1824 (*Voy. Uranie & Physicienne, p. 495*) scheint hervorzugehen, dass *Monophora* älter ist; sie schreiben "Bory—avait donné le nom de monophore à un mollusque, qui depuis a été appelé pyrosome Péron." Es empfiehlt sich den Namen *Pyrosoma* für alle Fälle zu sichern.

(3, 4) *Salpa* Forskål, 1775, und *Cyclosalpa* Blainville, 1827.—Diese beiden Genera sind durch Ihle, 1911 (Zool. Anz., v. 38, pp. 585–589) verteidigt und auch in seine Bearbeitung in "Das Tierreich" (v. 37, 1912; Siehe auch Nota p. 27, von F. E. Schulze) übergegangen. Wir glauben uns mit diesem Hinweise[1] begnügen zu können und erlauben uns noch an die gegenteiligen Aufsätze[1] von Poche (Zool. Anz., v. 32, 1907, pp. 106–109; v. 39, 1912, pp. 410–413) zu erinnern.

(5) *Appendicularia* Fol, 1874.—*Appendicularia* wurde von Chamisso & Eisenhardt, 1820 (N. Acta Ac. Leop., v. 10 (11), p. 362, t. 34 f. 4), für eine arctische, nicht erkennbare Art, aufgestellt. Fol hat 1874 (Arch. Zool. exper., v. 3, notes, p. 49) den Gattungsnamen für die tropische Art *Appendicularia sicula,* die von der arctischen sicher generisch verschieden ist, übernommen und darauf hin hat sich der Name in letzterem Sinne allgemein eingebürgert. *Appendicularia* würde anderenfalls eine Species incerta enthalten und für *Appendicularia* mit der Species *sicula* würde ein neuer Gattungsnamen aufzustellen sein. Der Name der Ordnung Appendicularidæ würde verschwinden.

(6) *Fritillaria* Fol, 1874.—Quoy & Gaimard, 1834 (Voy. Astrolabe, v. 4, p. 306) stellen den Namen Frétillaires auf [(Fritillaria Huxley (1851, Philos. Trans. (London), part 2, p. 595), Fritillaire C. Vogt, 1854 (Mém. Inst. Genève, v. 2, no. 2, p. 74)], identificierten ihn aber sofort mit *Oikopleura* Mertens, 1831. Um den Namen *Fritillaria* zu retten, hat Fol, 1874 (Arch. exper., v. 3, notes, p. 49) ihn in bestimmten von früherem abweichendem Sinne gebraucht, in welchem er sich vollständig eingebürgert hat. *Fritillaria* würde Synonym zu *Oikopleura* und eine Neubennung nötig.

[1] The secretary spends an average of about six (6) hours per week in studies and correspondence for the Commission on Nomenclature, and *he earnestly requests all persons to give full details with full references to every case submitted.* Even slight omissions cause a loss of time. The secretary also respectfully requests that authors submit their cases in typewriting, rather than in handwriting.—C. W. S.

C. Apstein (Berlin), A. Borgert (Bonn), G. P. Farran (Dublin), G. H. Fowler (Aspley-Guise), R. Hartmeyer (Berlin), W. A. Herdman (Liverpool), J. E. W. Ihle (Utrecht), H. Lohmann (Hamburg), W. Michaelsen (Hamburg), G. Neumann (Dresden), C. Ph. Sluiter (Amsterdam), F. Todaro (Rome).

C. W. Stiles,
Secretary of Commission

SPECIAL ARTICLES

A RUST—NEW ON APPLES, PEARS AND OTHER POME FRUITS [1]

For several years the writer has been studying an interesting rust on several cultivated and native species of the pome family. In 1908, the æcial stage of this rust was found on the serviceberry (*Amelanchier florida* Lindl.) and on the thornapple or haw (*Cratægus douglasii* Lindl.); later, the same rust was found on apples, pears, quinces and related fruits, as noted below. The rust on *Amelanchier florida* and *Cratægus douglasii* has been referred to *Æcidium blasdaleanum* D. & H., the telial stage, *Gymnosporangium blasdaleanum* (D. & H.) Kern., occurring on the incense cedar (*Libocedrus decurrens* Tor.).

During the past six years the writer has paid particular attention to this rust for the reason that it seems to be of considerable economic importance. While it occurs rather sparingly on practically all varieties of apples so far observed, it has been found to attack certain varieties of pears very seriously. Quinces are also subject to considerable injury by this rust. In 1910, and again in 1912, this rust was so serious in a block of Winter Nelis pears as to practically destroy 95 per cent. of the crop. The fruit was badly deformed and fully 50 per cent. of the leaves were found infected. The fruit and stems in many cases were completely covered with æcia, distortion and dropping of the fruit being the result. All varieties of pears are not equally susceptible, but both European and Oriental varieties were found affected. Oriental hybrids

[1] A preliminary paper.

also showed infection in a more or less serious degree. This rust is not rœstelia-like, as in the case of the more common apple rust and other rusts whose telial stage is a Gymnosporangium. The incense cedar which bears the telial stage is very common in southern Oregon, being found on the floor of the Rogue River Valley at an altitude of 1,400 feet. The proximity of incense cedar trees to apple and pear orchards is therefore of considerable economic importance.

The hosts upon which the æcia of this rust have been found are:

Malus malus (L.) Britton (apple).

Malus floribunda Sieb. (several varieties) (flowering crab).

Pyrus communis L. (pear).

Pyrus chinensis (Oriental pear).

Pyrus sitchensis (Roem.) Piper (mountain ash).

Malus diversifolia (Bong.) Roem. (native crab apple).

Cydonia vulgaris (L.) Pers. (quince).

Cydonia japonica (Thumb.) Pers. (Japan quince).

Amelanchier florida Lindl. (serviceberry).

Cratægus douglasii Lindl. (thornapple or haw).

Culture records and final proof will be given in a detailed paper which will be published in the near future. This preliminary paper is given simply as a statement as to what has been found.

P. J. O'GARA

PATHOLOGICAL LABORATORY,
MEDFORD, OREGON,
September 1, 1913

A POSSIBLE MUTANT IN THE BELLWORT (OAKESIA SESSILIFOLIA) WHICH PREVENTS SEED FORMATION

THE sessile-leaved bellwort (*Oakesia sessilifolia*) is used in many elementary classes in botany as a convenient type to illustrate the Lily family. The normal pistil with a single detached stamen is shown in Fig. 1, magnified three diameters. There are three stigmas terminating styles which are free at their extremities. In class material collected late in the spring of 1912, flowers were discovered with pistils of the form shown in Fig. 2. The pistil is shorter and thicker than in normal flowers but the essential abnormality consists in the transformation of the three stigmas into func-

FIG. 1.

tional stamens, each with a pair of pollen sacs. Aside from the hermaphroditism of the pistil, the abnormal flowers do not differ in appearance from typical blossoms and bear their full quota of six normal stamens. The stigmatic anthers are well formed and filled with perfect pollen indistinguishable from that produced in typical anthers. In three per cent. grape sugar as well as in cane sugar, pollen from the two

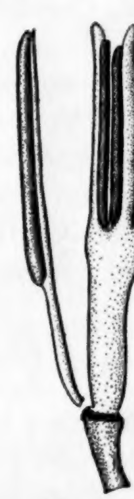

FIG. 2.

types of anthers show an equally high per cent. of germinations. Eleven attempts were made last spring to pollinate normal pistils with pollen from abnormal flowers, pollen both

from stigmatic and from typical anthers being used, but in no case did seed set. Very few capsules were found with seed this last season, however, on untreated plants. In the spring of 1913 search was made for flowers with stigmatic anthers. Of 305 flowers examined from a woodlot which comprised about five acres, there were only 13 with stigmatic anthers. Twelve were found in a patch about 10 ft. square and a single specimen 100 ft. distant. A single flower with stigmatic anthers, however, had been found the previous year about 200 yards from the patch just mentioned. Some few of the flowers classed as normal had rudimentary pistils though normal stamens. One hundred and thirty-two flowers from outside this woodlot were found to be normal. The total number is not sufficient to warrant one in making a suggestion as to the probability of the abnormal form having originated in this single locality.

The transformation of stigmas into anthers seems to completely block the possibility of fertilization, for the ovules which are laid down in deformed pistils have never been found to develop. The abnormality described, therefore, has a double interest. It not only shows an alteration in the products of an organ with a highly stereotyped sexual development, but it also offers an instance apparently of a mutation directly unfavorable to the reproduction of the species. In consequence the subject has seemed worthy of further investigation and the present note is to call attention of botanizers this spring to the possible occurrence of the abnormality in other localities. We should be glad to correspond with any one finding abnormal flowers of the bellworts.

A. F. Blakeslee,
A. F. Schulze
Connecticut Agricultural College,
Storrs, Conn.

SOCIETIES AND ACADEMIES

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

At the 470th regular meeting of the society held December 16, 1913, James Mooney, of the Bureau of American Ethnology, delivered an address on "The Gaelic Factor in the World's Population." The speaker dealt chiefly with the Irish Gaels and drew a distinction between the Irish of native Gaelic stock and the unassimilated alien element massed in several of the northeastern counties as the result of the "Plantations" under James I. and Cromwell. This alien element was of English and Lowland Scotch stock, with a slight Highland Gaelic infusion, Protestant in religion and mostly Unionists in politics, while those of the old native stock were as solidly Catholic and Nationalist. Speaking broadly, in Ireland the Catholics represent the original Gaelic stock; the Episcopalians, those of English stock, and the Presbyterians and Methodists, those of Scotch origin, constituting respectively about 74, 13 and 11 per cent. of the total population. The present Gaelic race of Ireland is a blend of the Gael proper, a Keltic people who arrived in the country probably from northern Spain about 1,000 B.C., and of all other races who preceded or followed them up to the end of the thirteenth century, including the neolithic man, the unknown megalith builders, the dark-haired Firbolg, the Picts, Danes, Normans and Welsh. The Irish immigration to the American colonies previous to the Revolution was mainly of the alien Scotch and English element, known sometimes as Scotch-Irish. The Gaelic Irish immigrants did not begin to arrive in any great number until after the war of 1812, excepting in Maryland.

The wars growing out of the Reformation and the Stuart contests reduced the Irish race from an estimated two and a half million in 1560 to about 960,000 at the end of the Cromwellian war in 1652. In 1845 it reached its maximum estimate of 8,500,000. Then came the great famine of 1846–47. Within three years nearly 1,500,000 perished of hunger or famine fever. This started the great flood of emigration by which Ireland has lost virtually one half its population within sixty years. In 1911 it stood at 4,390,219, the lowest point reached in over a century. Owing to governmental and economic conditions this decrease has been chiefly at the expense of the old native Gaelic stock rather than the Planter stock, the Gaelic percentage, as indicated by the religious statistics, having fallen from 83 to 74. In the sixty years ending March 31, 1911, according to the official British figures, 4,191,552 emigrants left Ireland, or nearly as many persons as are now living in the country. About three million of these came to the United States, the total Irish im-

migration to this country from 1821 to 1900 being, officially, 3,871,253. From 1821 to 1850 the Irish constituted nearly one half of all our immigrants. Previous to the Revolution the "Scotch-Irish" immigration was so great than in an official Parliamentary inquiry in 1778 it was asserted that nearly one half of the American Revolutionary Army was of Irish origin. Since 1870 the number of Irish-born in the United States has steadily decreased, by death and dwindling immigration. According to the census of 1910 there are now in the United States of Irish birth or parentage, 4,504,360. This does not include any of the 811,000 non-French Canadians in the United States, of whom a large proportion are of Irish blood, or any of the 876,000 coming from England, of whom also a large number are of Irish origin. Neither does it include any of the 1,177,000 American born "of mixed foreign parentage," including such parentage combinations as Irish and Germans, which alone probably runs above fifty thousand. Among the states, New York stands first with 1,091,000 of Irish birth or parentage; Massachusetts second, with 633,000, and Pennsylvania third, with 570,000. For all these figures it may be asserted that more than four fifths are of Gaelic stock.

By the latest British census, 1911, the population of Ireland was 4,390,219, of whom all but 157,037 were native born. Of the native born about 74 per cent. or 3,245,000 represent the old Gaelic stock. By the same census there were 375,325 persons of Irish birth then living in England and Wales, while an unofficial estimate puts those in Scotland at about 220,000 or nearly 600,000 for the whole island, which with the children of Irish parentage would probably total at least 1,500,000. The same census gives 139,434 Irish born to Australia, or perhaps 350,000 of Irish blood. South Africa and the other British colonies, exclusive of Canada, have (estimated) 100,000 of the same stock, while Canada has in round numbers 990,000 of Irish birth or parentage, of whom about 750,000 are of Gaelic origin, as indicated by religious denomination. Outside the countries already named, Argentina has some 15,000 Irish born and the rest of Latin America possibly as many more, with perhaps another 15,000 or 20,000 scattered over the rest of the world. To sum up, the total Irish-born population throughout the world is now about 6,875,000, or about 1,625,000 less than the population of the home country alone in 1845, while the whole number of unmixed Irish blood may be about seventeen million, of whom nearly fifteen million are of Gaelic stock. The total Gaelic population—Irish, Scotch and Manx—of fairly pure stock and racial identity, in every part of the world, probably numbers close to twenty million.

At a special meeting of the society held on January 6, at the National Museum, Dr. Truman Michelson, of the Bureau of American Ethnology, delivered an address, "Notes on the Fox Indians of Iowa." Their own native name is Meskwa'ki'ʌg[1], "Red-Earths"; the French name, *les Renards*, is derived from the appellation of a single gens, Wāgō'ʌg[1], "Foxes"; the English name "Foxes" is a translation of the French *les Renards;* the term "Outagamies" (and variants) is derived from the Ojibwa Utʌgāmīg, "they of the other shore." Their closest linguistic relations are first with the Sauk, then the Kickapoo, then the Shawnee, and then the so-called Abnaki tribes. They are also comparatively close to the Menominee and Cree as compared with the Ojibwa, Otawa and Potawatomi. The thesis that the Foxes were once an Iroquoian people and subsequently took up an Algonquian dialect can not be substantiated. There is presumptive evidence that the Foxes were once in the lower Michigan peninsula. However their proper history begins in the last half of the seventeenth century in Wisconsin on the Wolf and Fox rivers. After the famous Black Hawk war, the Sauks and Foxes sold their remaining lands in Iowa and agreed to remove to Kansas. Nevertheless small bands of the Foxes returned continually to Iowa. In 1856 the Iowa legislature passed a bill enabling the Foxes to settle in that state. Accordingly they purchased land with their own money, near Tama, Iowa. From time to time this has been added to till they now own about 3,000 acres. The main body of the Foxes did not leave Kansas till the outbreak of the Civil War. In 1896 the state of Iowa relinquished jurisdiction of the Foxes to the federal government, and at the same time certain claims of the Foxes against the Sauks were adjusted. There are some Foxes enrolled with the Sauks of Kansas and Oklahoma; the present population of those in Iowa is about 356.

At the 471st meeting of the society, held January 20, 1914, at the National Museum, Mr. William H. Babcock spoke on "The North Atlantic Island of Brazil," illustrating his address with lantern slides of early maps. Attention was called to three Brazils, that of South America, the Mount Brazil in Terceira and that of the western Ireland peasantry who still believe in a great land called Brazil or Breasail west of them in the

ocean. This last is probably the original Brazil, from which the others received the name, it being identical with that of a mythical pagan Irish hero and also practically with that of St. Bresal. Outside of Ireland it first appears in the expression "grana de Brasile"—grain of Brazil—in a commercial treaty of Ferrara, Italy, dated 1193, and another Italian document of 1198. The speaker suggested that the primary Brazil, west of Ireland, may have been the region surrounding the Gulf of St. Lawrence. The maps of Dalorto 1325 and Dulcert 1339 were presented as the first showing Brazil, a nearly circular figure west of southern Ireland. The corroborative testimony of the Norse sagas as to Great Ireland and the opinion of Dr. Storm and Dr. Fisher identifying Brazil with Markland are best supported by the Catalan map of 1480. The general argument was that some who spoke Irish reached the St. Lawrence Gulf region at a very early period and gave it the name Brazil.

AT a special meeting of the society held February 3 at the National Museum, Miss Frances Densmore, of the Bureau of American Ethnology, read a paper on "Sioux War Songs," using the stereopticon, the phonograph and vocal selections in illustration of her theme. A number of native drawings of war incidents were shown. War among Indians was not an occasional calamity, it more nearly resembled a steady occupation. To the individual it offered a career. A man could best become rich and honored by going to war. A man was rated according to his generosity, and having given away his goods there must be some way of securing a new supply of wealth. A war party afforded this opportunity. War was a means of revenge, was for the defence of the home and was the protection of the hunting ground which meant the food supply. A war party traveled far and brought back strange tales of distant lands. New customs were frequently introduced into the tribe as a result of war expeditions or the taking of captives. Only a successful warrior could belong to the leading societies of the tribe, with their special tents for meeting, their feasts and their parades. But the greatest reward was the right to sing of one's valor at the assemblages of the tribe.

DANIEL FOLKMAR,
Secretary

THE NEW ORLEANS ACADEMY OF SCIENCES

THE annual meeting of the Academy was held in Tulane University on Tuesday, March 17, with President Dr. Isadore Dyer in the chair and a full quorum of fellows and members. The following resolutions were passed upon the death of Dr. Alcee Fortier:

WHEREAS, By the death of Dr. Alcee Fortier the New Orleans Academy of Sciences has lost one of its oldest fellows, one who took an active part in the reorganization of the Academy in 1886, was its corresponding secretary from 1886 to 1890, and published a valuable contribution on Romance Philology in the proceedings of 1888,

Resolved, That we, the fellows and members of the New Orleans Academy of Sciences, do hereby express our sincere appreciation of his most valuable services to this organization, not only in his official capacity as secretary, but also as a scholarly contributor to its proceedings and furthermore our deep sense of the loss which the Academy has sustained by his death.

Resolved furthermore, that a copy of these resolutions be incorporated in the minutes of the Academy and that copies also be sent to his family, to SCIENCE and to the press of this city.

Officers for the ensuing year were elected as follows:

President—W. B. Gregory, professor of experimental engineering, Tulane University.

First Vice-president—Gustav Mann, professor of physiology, Tulane University.

Second Vice-president—W. A. Read, professor of English, Louisiana State University.

Secretary—R. S. Cocks, professor of botany, Tulane University.

Treasurer—Ann Hero, professor of chemistry, Sophie Newcomb Memorial College.

Librarian-Curator—J. H. Clo, professor of physics, Tulane University.

Corresponding Secretary—Pierce Butler, professor of English, Sophie Newcomb Memorial College.

The scientific program consisted of the following papers: (1) "Some Theories of Valence," by H. W. Moseley. The paper traced the development of the doctrine of valence from a historical view-point. Some of the modern theories were then taken up in more detail, especially the theories of Abegg, Spiegel and Arrhenius, Ramsay, Friend, Thompson and Werner. The paper closed with mentioning some recent observations of Bray and others upon valency and tautomerism. The paper was discussed by Dr. P. B. Caldwell. The second paper was by R. S. Cocks calling attention to several interesting facts connected with plant distribution in Louisiana, dealing especially with the eastern portion of the state.

R. S. COCKS,
Secretary